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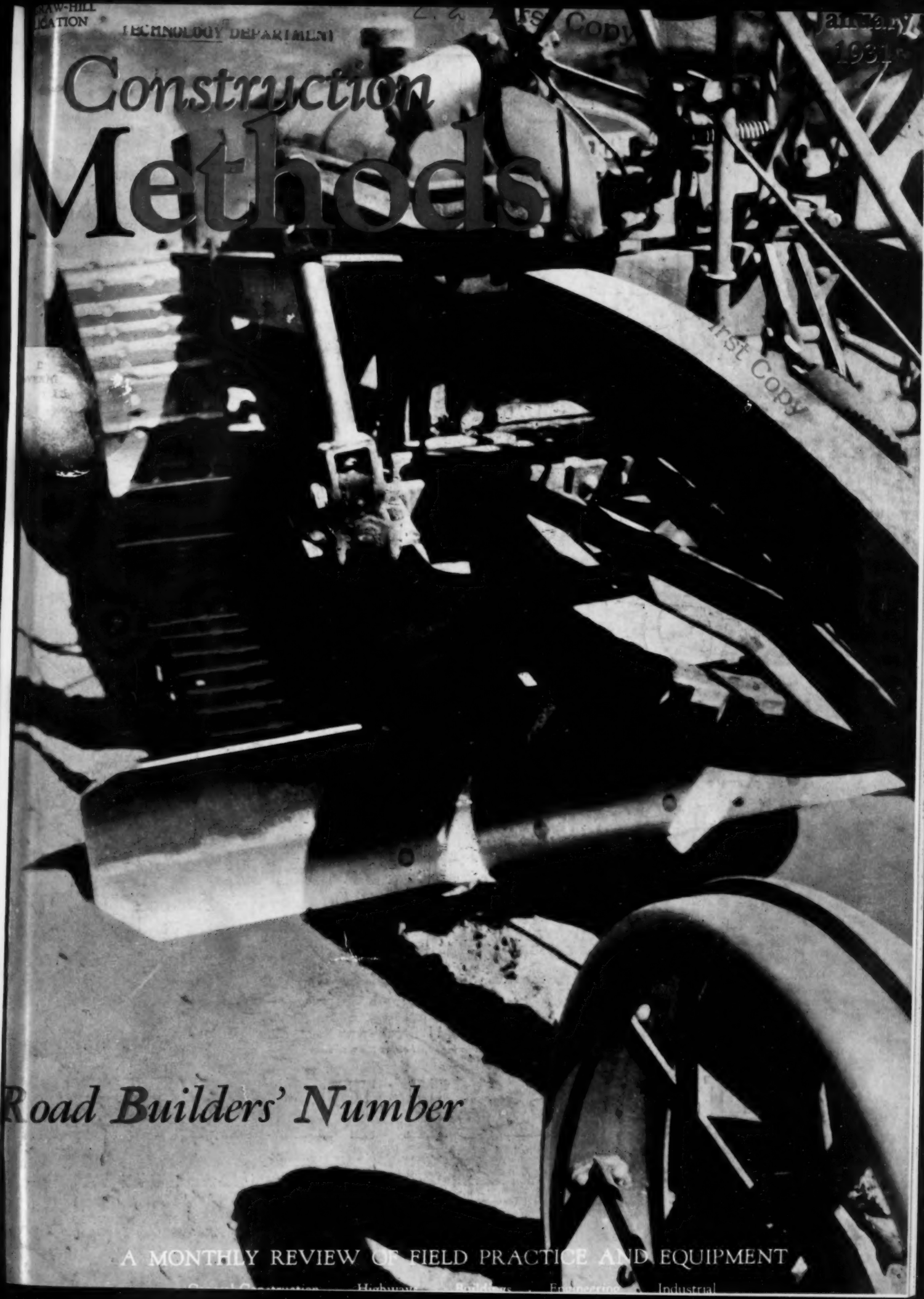
Construction Methods



Road Builders' Number

A MONTHLY REVIEW OF FIELD PRACTICE AND EQUIPMENT

General Construction — Highways — Buildings — Engineering — Industrial

R v. 13 1931

Wherever You Go You See Them

Through the desert, over the mountains, across the plains—wherever the trail leads—you will find I-R Portable Compressor outfits in use on the road-building projects of State and Nation.

Miles of fine, paved highways are now being carried through barren and rugged country which was formerly considered impassable. Ingersoll-Rand Portable Compressors, "Jackhamer" Drills, and Pneumatic Tools have played a tremendous part in these undertakings by lowering costs and speeding the work.

See these compressors and tools at Booths B-54 and B-69, St. Louis Road Show, Jan. 10-16, 1931

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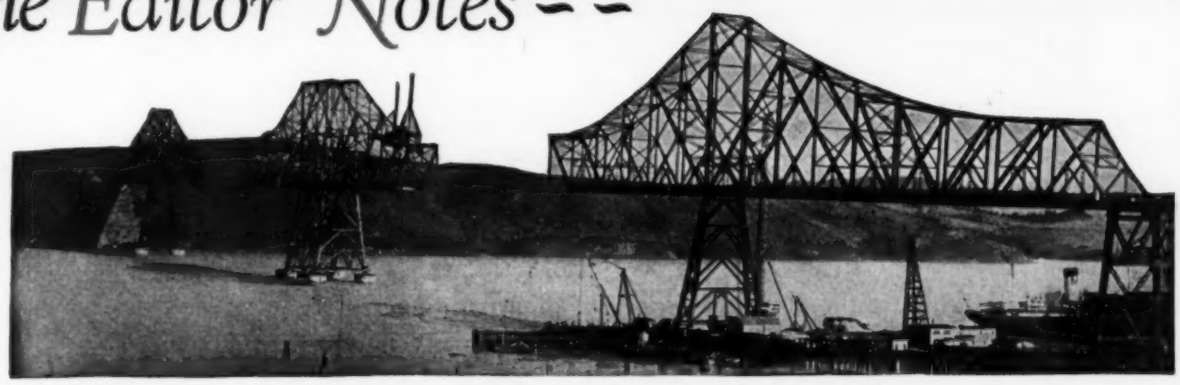
PORTABLE AIR COMPRESSORS

CONSTRUCTION METHODS, January, 1931. Vol. 13, No. 1. Published monthly. McGraw-Hill Publishing Company, Inc., Tenth Avenue at Thirty-sixth Street, New York, N. Y. $1 per year; 10 cents per copy. Entered as second-class matter, October, 1926 issue. Vol. 8, No. 19, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

TECHNOLOGY DEPT

The Editor Notes - -



The Annual Road Builders' Number

AS USUAL on the eve of the convention of the American Road Builders' Association, *Construction Methods* this month presents its annual Road Builders' Number. The year 1930 has brought forth two experiments which promise to have a large effect upon the business of road building. Initial trials of paving mixers in tandem and of sheet metal base for brick paving are more important because of implied possibilities than because of demonstrated value. The first may introduce a change of equipment and a higher speed in laying concrete; the second may enter the competition of pavement designs for first-class roads. Both subjects are described in articles elsewhere in this issue.

The operation of two standard paving mixers in tandem is a makeshift arrangement. The machines are designed for individual operation. Even so, the dual mixers may effect economies, as the article in this issue would seem to indicate. The experience thus far suggests the possibility of two drums on one machine, with the first discharging into the second. Such a scheme would reduce the equipment cost, decrease the number of operators from two to one, and save the time consumed in hoisting the second skip. Against its advantages must be weighed the unwieldy size of the double-drum paver. The manufacturers already are investigating its practicability. If its dimensions can be brought within manageable limits, the double-drum machine may some day become a reality.

Sheet metal base for pavement, the second innovation last year, appears entirely sane and practical from a design viewpoint. Only actual trial, such as it is now undergoing, can determine its utility. The obvious factor which might limit its adoption is cost. Promoters of the present experiment believe that metal sheets of sufficient strength and durability can be designed to sell at a cost comparing favorably with that of other types of base. Use of a factory-made and factory-controlled product may prove advantageous. Maintenance may be simplified. If the test is successful, its effects are bound to be felt.

CONSTRUCTION METHODS

A monthly review of modern construction practice and equipment

ROBERT K. TOMLIN, *Editor*

Editorial Staff

VINCENT B. SMITH NELLE FITZGERALD
J. I. BALLARD (San Francisco)

WILLARD CHEVALIER, *Publishing Director*

A McGraw-Hill Publication
Tenth Avenue at 36th Street, New York

Construction Methods was founded in 1919, under the name *Successful Methods*, by the Manufacturers Publicity Bureau, Inc., of Chicago, representing a group of non-competing manufacturers of construction equipment. Charles R. Thomas, editor of the first few issues, was succeeded by William Jabine.

In 1926 the McGraw-Hill Publishing Company, Inc., of New York, purchased the publication, changing its name to *Successful Construction Methods* in November of that year and to *Construction Methods* in May, 1927.

Robert K. Tomlin was appointed editor of *Construction Methods* in January, 1928. Vincent B. Smith and J. I. Ballard (San Francisco) are assistant editors and Nelle Fitzgerald editorial assistant.

To Stop Overruns

Every builder of concrete roads is concerned with the vital problem of minimizing overruns. Inattention to such details as proper setting of forms, accurate sub-grading, sagging templates, and worn parts on finishing machines can combine to use up far more costly concrete than is actually required by the specifications. Some practical hints on preventing overruns are discussed by a construction superintendent on page 74. The article is presented in readable, conversational style. If you are an engineer or a contractor seeking to avoid waste on a concrete road job, show this story to your superintendent and foremen.

Findings on Seasonal Employment

HEADED by William Joshua Barney, a committee of the New York Building Congress has just submitted a report on seasonal employment in the building trades during 1928-29. The study is based on figures obtained from building trades unions and from general contractors and follows a similar investigation undertaken in 1922. That year showed a seasonal variation in employment of 45 per cent as against a variation of only 20 per cent for the period 1928-29. For this noteworthy result a number of reasons are suggested, including educational work, increased winter weather construction and the necessity for more rapid building progress to reduce financial costs.

In view of the present unemployment crisis, the committee's recommendations to reduce the seasonal peaks and valleys in the employment curve are particularly timely. They are:

(1) Establish a wider range of rental period dates.

(2) Regulate government, state, city, public utility, religious and educational building construction so that these types will come during the seasonal periods of low employment.

(3) Regulate the construction of new buildings and additions that are erected for owner's prearranged occupancy without regard for investment returns, so that they will come during the seasonal period of low employment.

(4) Encourage beginning work on new construction March 1, instead of the customary date of May 1, thereby bringing labor demand two months ahead of the demand peak, with a greater supply available.

(5) Plan maintenance and repair work so that it will come during the season for which there is a low demand for the labor involved, subject to emergency conditions that must be considered.

(6) Wherever possible, adapt the demand for "inside" and "outside" work to the labor available as indicated by a study of periods of building activity and slackness.

The committee urges employers of labor and unions to cooperate in keeping employment records on a quarterly basis.

What of 1931?

WE SHALL let the Standard Statistics Company write this page.

Standard Statistics is one of the most authoritative and widely respected of the business report services. Recently it published a survey of the building and construction field, reviewing recent trends and offering an estimate of the prospects for the near future.

Comparing probable construction volume during the 5-year period, 1930-1934, with actual performance in the years 1925-1929, this authority concludes that residential building will recede somewhat more than 12%, that commercial building will lag by more than 4%, that public, semi-public and industrial buildings will about hold their own, that educational buildings will gain somewhat more than 4%, *while public works and utilities will gain more than 10%.*

Turning to the more immediate future, the survey comments as follows:

> "The one bright spot of importance in the industry is the advance of public works and utilities construction to new peak levels this year. Despite a let-down in this group in September (1930), October results proved relatively satisfactory, with the consequence that contract awards for the first ten months were 15.6% larger than in the corresponding period last year and 11.6% above the 1928 peak.*****
>
> "Prospects for 1931 fully sustain the glow of the picture, because construction in this field should be well maintained, if not further stimulated, by virtue of the campaign now under way to increase expenditures for national, state, and local improvements in order to combat the unemployment situation."

With the backlog of a large volume of contracts awarded during recent months and with the outlook for a continuing increase, 1931 offers bright prospects for business in every variety of public works and utilities construction.

Willard Chevalier

Publishing Director

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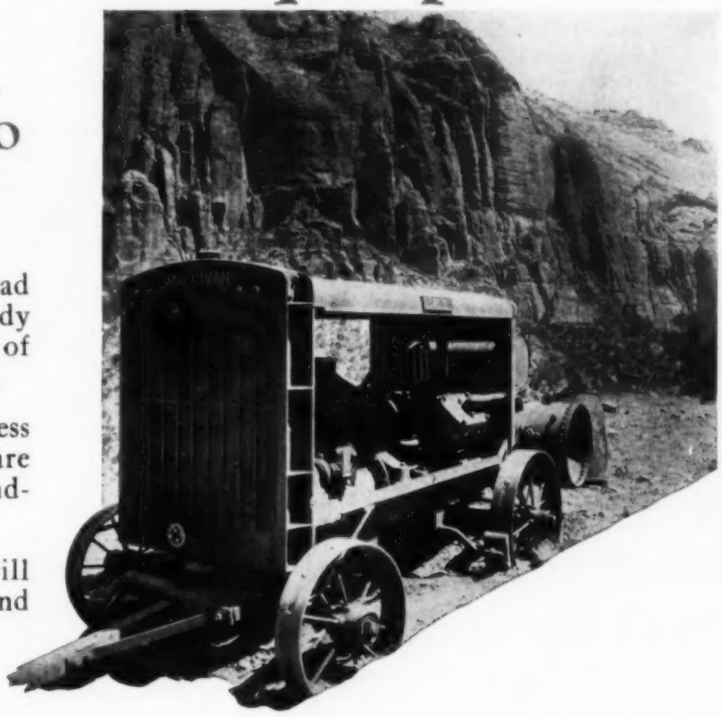
New Sullivan Equipment

at the Road Show will point the way to a profitable 1931



1931 will be a good year for alert road builders. And many contractors will study exhibits at the Road Show, for means of reducing estimates, and increasing profits.

Three of the eight Sullivan Vibrationless compressors will be on exhibit. They are becoming the standard source of dependable air power.

A Sullivan Portable All-Hammer drill sharpener will make precision bits and shanks for the crowd which always gathers about it.

New concrete breakers and rock drills—a new anti-freeze system for pneumatic tools—new Stringalite portable lighting cable — a pavement core drill — and a Turbinair hoist will be on exhibit in the *Sullivan Booth, B-39, in the north end of the west building.*

See these products at the Show, or send for the Sullivan Road Show Bulletin.

New Sullivan Busters

Three new Sullivan Busters will be on display in St. Louis. Also Spaders, and several Rock Drills. These tools will be operated in the booth.

Sullivan Pavement Tester at work.

Tanner-Tank Anti-Freeze

Don't fail to see the new Tanner Tank. It absolutely prevents freezing of tools or air lines at 40 degrees below zero. It peps up tools in warm weather. Obviates need of fires on air lines, and alcohol dripping.

Bulletin on request.

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One of a fleet of Model SHS Autocar dump trucks owned by Ryberg-McHugh & Cowley, of Boise, Idaho, is shown co-operating with a Northwest shovel. This Autocar is rated at 3½ tons, has a 114-inch wheelbase, 38 x 9.75 balloons, dual rears, and a dump body with Heil hoist. Its turning radius is only 19 feet, 6 inches.

FOR OUT-AND-OUT ECONOMY ON CONSTRUCTION WORK NOTHING CAN EQUAL THE 114-IN. WHEELBASE AUTOCARS

CHASSES built to the highest precision standards in the industry; the great Autocar Blue Streak 6-cylinder engine; more than one hundred bushings and small renewable parts; the finest metals obtainable—these are some of the important reasons for the outstanding economy of the several Autocar chasses designed specifically for construction work . . . In addition to all these economical factors, the 114-inch wheelbase Autocars have additional money-saving advantages. Their compact design saves on garage space; their easy handling in cramped quarters saves valuable time on the job; where the route runs through heavy traffic, their flexibility gives them the jump on other trucks. . . . By locating the engine under the seat, no room for pay load is sacrificed and the entire unit is in better balance, with the load more equally distributed on all four wheels. . . . Write for the complete story on Autocar trucks for construction work. It may be the means of helping you to bigger profits in 1931.

AUTOCAR TRUCKS

PRECISION BUILT

THE AUTOCAR COMPANY, *Ardmore, Pa.*

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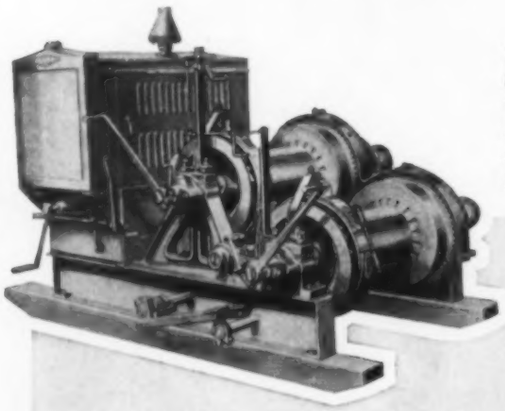
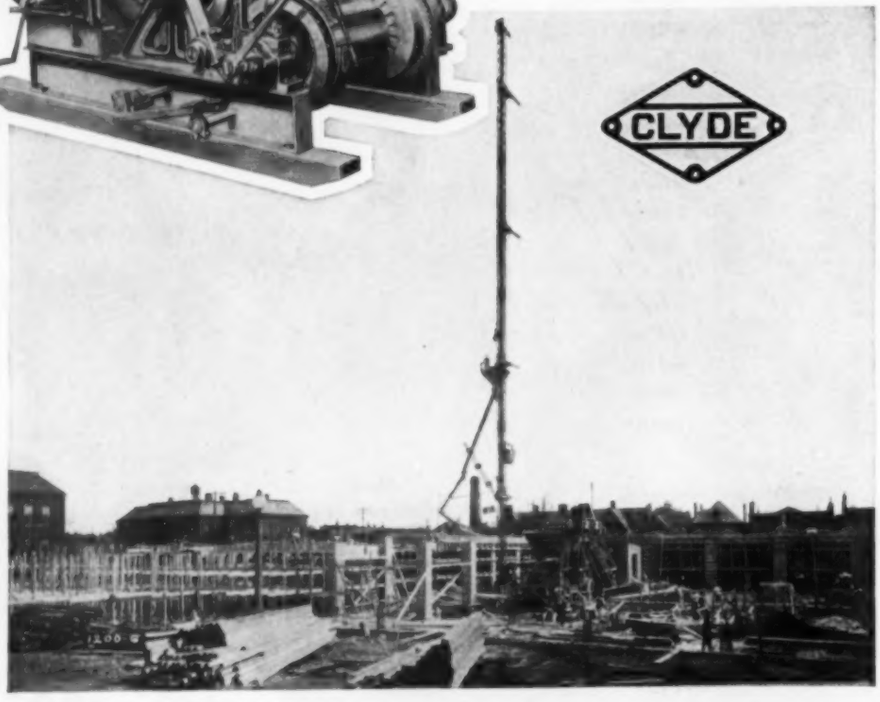
IF IT'S A CLYDE:—

If the hoist on your job is a Clyde, you'll have dependable hoisting power whenever you need it. You'll have no worries about hoist failures, no break downs or loss of hoisting time. You'll have economical maintenance, easy operation and long and lasting service. You'll save time and money—if it's a Clyde.



The illustration shows a Clyde two drum gasoline hoist operating one yard concrete bucket on Hadley Vocational School building in St. Louis, for the John Hill Construction Co.



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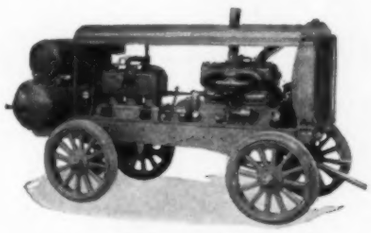

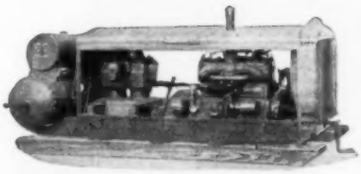

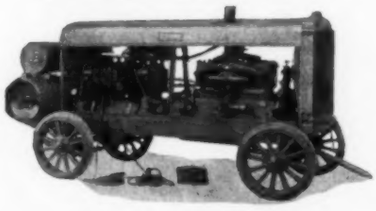

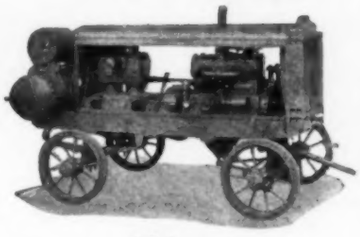

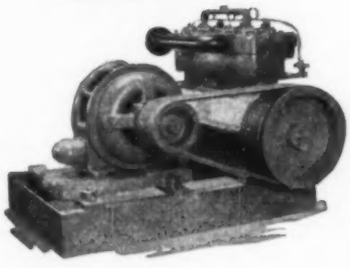

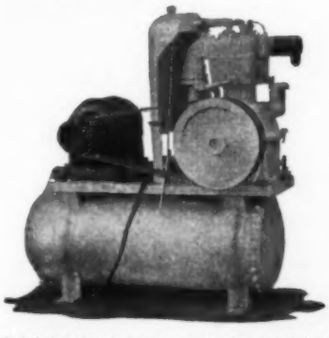

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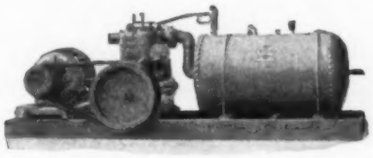

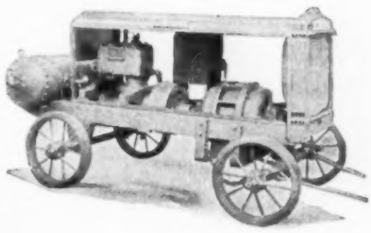

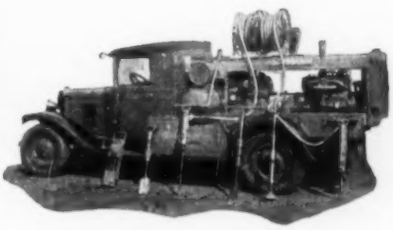

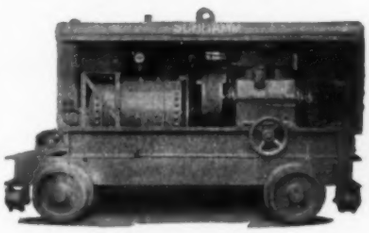

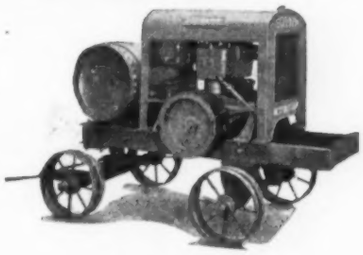

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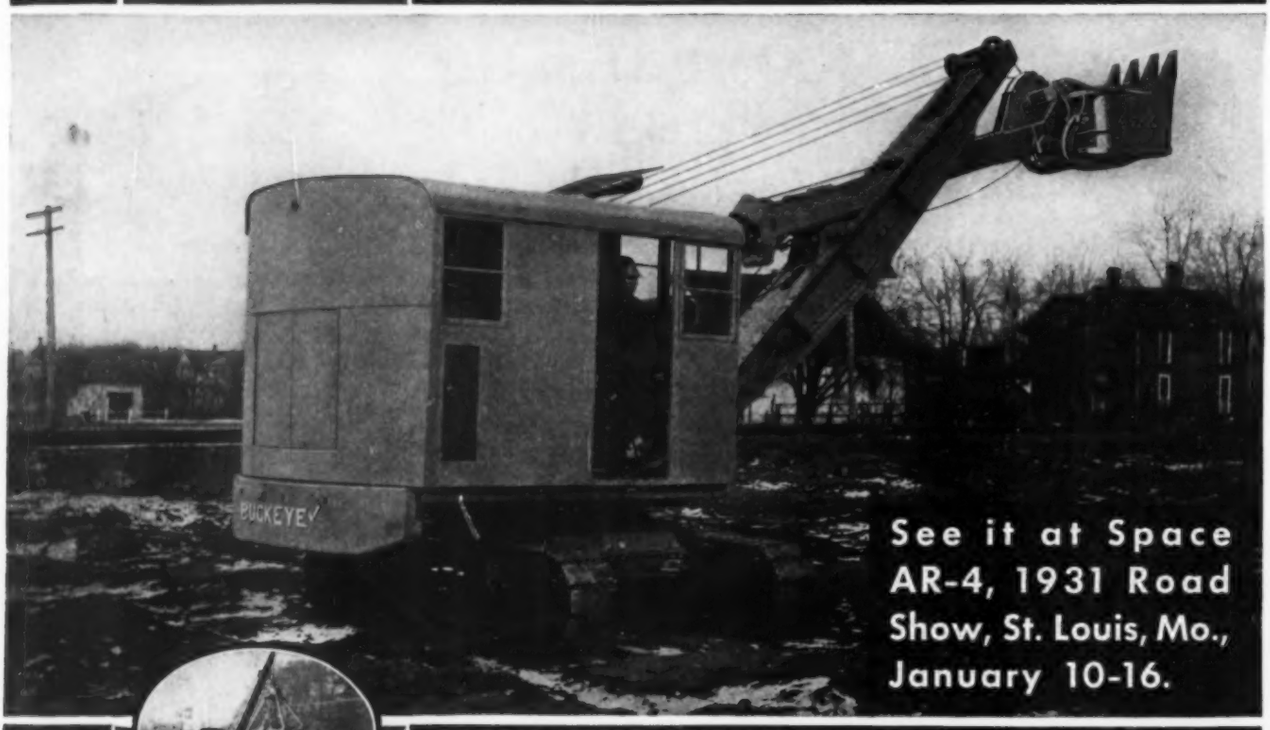

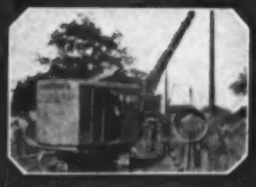

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Built into the compact, sturdy new Buckeye ⅜-yard full-revolving shovel is a wide, profitable service range never previously available in any equipment of its class—*at its price.*

The public in general (road and street contractors especially) is cordially invited to inspect this handy little unit at the 1931 Show. Mechanically, you will find that it fully measures up to Buckeye's rigid standards for dependable power, speed and economy.

Distinguishing features include electric starter and lights; full-length, steel-tread Alligator crawlers with provision for safe operation on grades; rotating and traveling bases of one-piece electric cast steel; 50 h. p. heavy-duty, medium-speed gasoline motor; fast hoisting and swinging speeds; rugged boom and dipper stick; and one-piece manganese steel dipper with removable, reversible manganese teeth points. One-man operation throughout.

As Clamshell, Crane, Dragline and Backfiller, Buckeye Model O—within its ⅜-yard capacity—has always offered greater earning ability per dollar of investment. Now, as a Shovel also, it will more than pay its way every day on some construction job or other.

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New but with an unparalleled background of experience and an array of field tested improvements—the new 43-B 1½-yard machine is ready to tackle the hard jobs of 1931.

Here are some of its profit making features — Speed, power and stability combined to make a 1½—1¾-yard shovel, dragline, clamshell or lifting crane with operating speeds of a much smaller machine.

1. Easiest possible convertibility.
2. Special extra-long and wide mountings for soft ground dragline work.
3. All continuously running shafts mounted on ball bearings.
4. Reversing bevel gears for swinging and propelling, completely enclosed and running in oil . . . ball bearing mounted in one rugged casting that prevents spreading of bevel-gears and insures permanent alignment.
5. Hoist-clutches power set—all operating levers toggle in.
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7. Gasoline, Diesel or electric power.

Send for the 43-B Bulletin, today.

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Shovels
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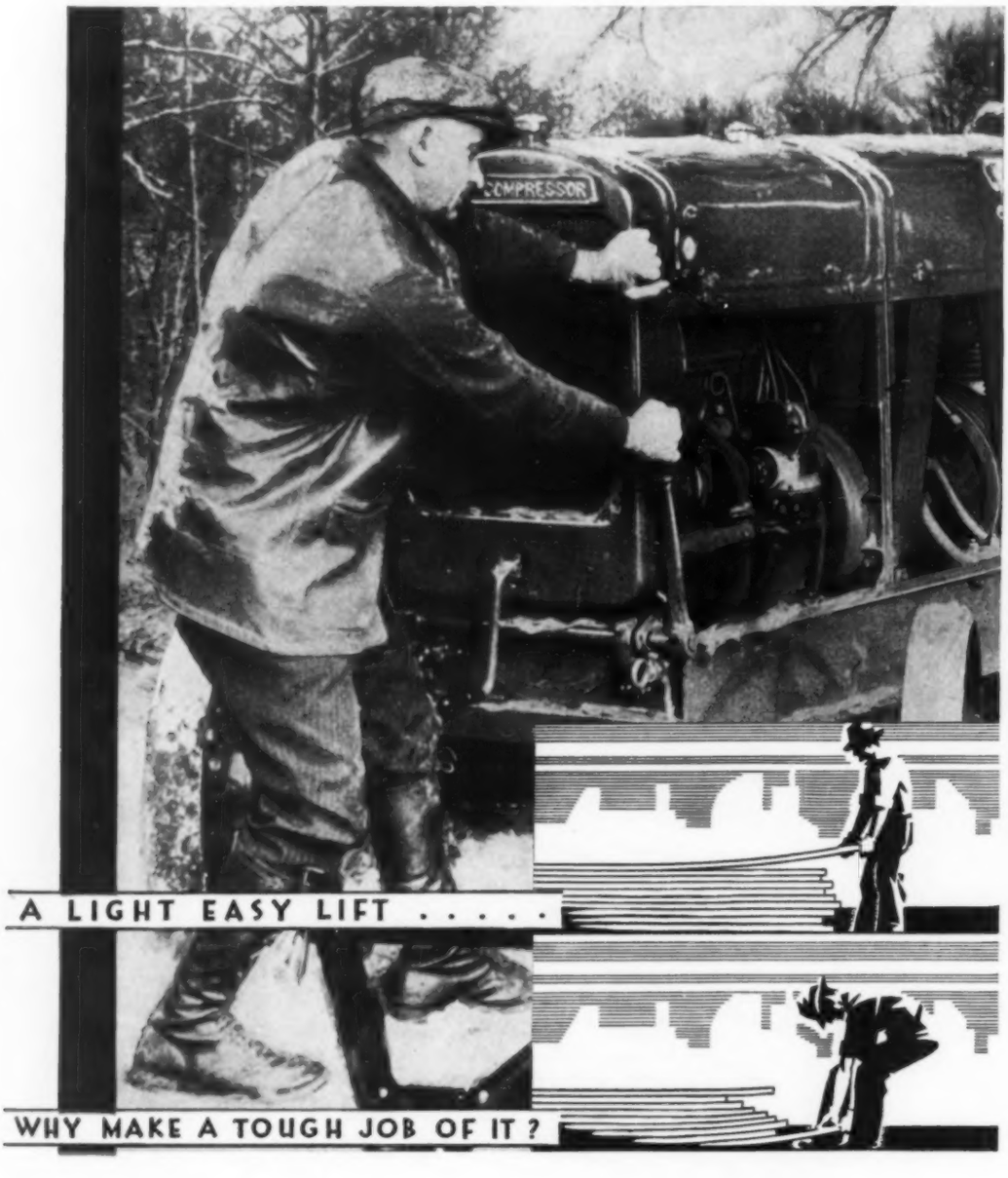
CRANK THE MOTOR ONLY—THAT'S EASY—THEN THROW THE CLUTCH!



AND you're all ready to go, no matter how cold the weather. Because with the Davey Compressor you crank the motor only—*not motor and compressor!*

Then, with your "Davey" happily started, it will make *you* happy, too, to see the way it goes at the job—*and stays by it!*

Capacity, for example: 142 cu. ft. of free air per minute, *every minute.* That means enough to operate two cement breakers, two rotating jack hammers in ordinary service, four tie tampers, or other tools of similar heavy requirements.

Then, steady performance: "Daveys" start at their top efficiency and keep right on at that rate—valves can't get clogged up with carbon and start "leaking back"—because *Davey Compressors can't form carbon!*

Carbon comes when compressor heads become overheated and scorch the tiny oil particles until they form a tight, thick "cake" of carbon on valves and seats. But Davey Compressors are air-cooled—no water jacket—so excess heat flows out through aluminum walls as fast as it's generated. Carbon doesn't form, even during several seasons' use.

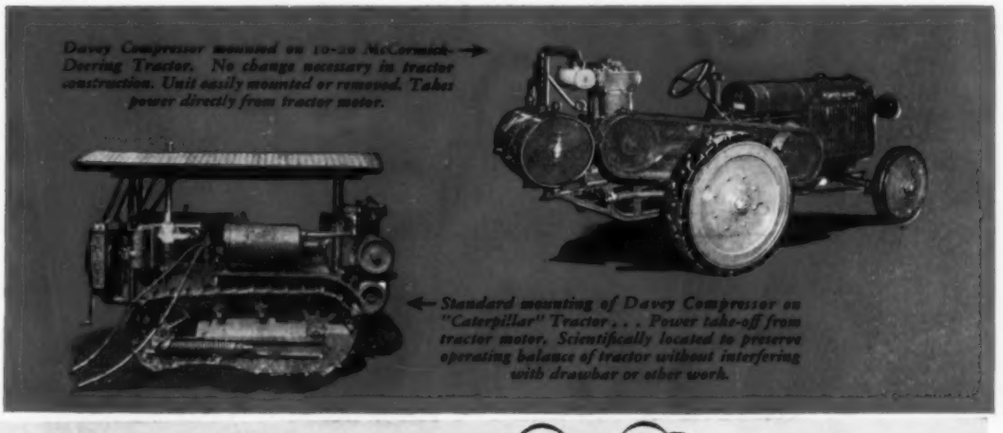
Davey construction is solid, rigid, enduring—yet a "Davey" weighs at least 1000 pounds less than does any other machine of similar rating and price.

Davey Compressors are *really portable*—furnished for mounting on trailers and skids with motor attached: also "Caterpillar" and McCormick-Deering Tractors with power taken from tractor motor. Take the Compressor straight to the spot where you need the air—don't bother with long, wasteful, costly pipe lines.

Of course you need to know more about Davey Compressors: of course we *want* you to! So just write your name and address on your letterhead, mail it in, and we'll do the rest. Thank you.

DAVEY COMPRESSOR CO., INC., KENT, OHIO

SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES


Davey Compressor mounted on 10-20 McCormick-Deering Tractor. No change necessary in tractor construction. Unit easily mounted or removed. Takes power directly from tractor motor.
Standard mounting of Davey Compressor on "Caterpillar" Tractor . . . Power take-off from tractor motor. Scientifically located to preserve operating balance of tractor without interfering with drawbar or other work.

DAVEY Compressors

AIR COOLED AIR

STEEL CLIMBS HIGH

UP AND UP . . fifty, sixty, seventy, eighty-five floors . . climbed the steel for the world's highest structure, the Empire State Building in New York City. The enormous investment of 55 million dollars in this mammoth building made it imperative that construction be speeded to a pace never before equalled. More than 50,000 tons of steel to be rolled, milled, fabricated and erected between March and September! C B's (Carnegie Beams) were selected for the job. In this crowded section of the city there was little space for temporary storage of steel beams. Shipping schedules had to be worked out and accurately timed. Very often the girders were lifted from the delivery trucks to their proper place in the structure!

Exceptionally heavy construction was required to carry the enormous load. The heaviest C B column section weighs 425 pounds per foot. For the main columns on the lower floors these sections were built up by fabrication to weigh 2357 pounds per foot!

Whether the job be large or small, the wide parallel flanges of C B sections present distinct advantages to the architect, engineer and builder. They will climb as high as man finds it economically desirable to build. 112

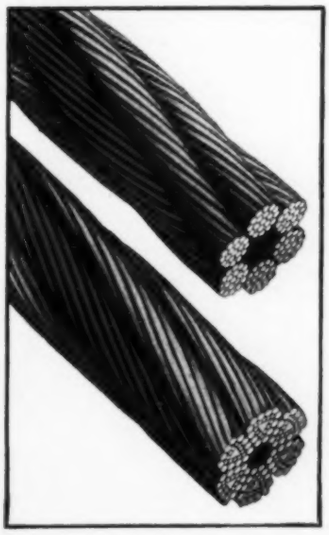
US STEEL

CARNEGIE STEEL COMPANY »» PITTSBURGH

Subsidiary of United States Steel Corporation

Strong Enough and Tough Enough for Hard Work of All Kinds

"HERCULES" (Red-Strand) Wire Rope is extra strong, yet its long life is not due to its strength alone, but to the fact that it is also able to stand a lot of bending and to offer great resistance to wear.



These vital qualities—in correct balance—are always present in "HERCULES" (Red-Strand) Wire Rope because it is made of acid open hearth steel wire, and because every wire used is first rigidly tested by us to make sure that it meets our exacting requirements.

"HERCULES" (Red-Strand) Wire Rope is made in both Round Strand and Patent Flattened Strand constructions. It is important to use the type of wire rope that will fit the conditions under which it is to work. If you will tell us the kind of equipment you have, we shall be glad to suggest the right rope for best results.

There will be more than 280 Exhibitors at the 1931 Road Show in St. Louis. Visit us at Booth No. A-32a.

Made Only by A. LESCHEN & SONS ROPE CO. **Established 1857**

5909 Kennerly Avenue
ST. LOUIS

New York **Chicago** **Denver** **San Francisco**

Distributors at over 100 different points. The name of our Distributor in any particular locality will be gladly furnished upon request.

All Contractors know this

The ability of Blaw-Knox to design, build and continually improve this *complete line* of Contractors' Equipment is gained through twenty-five years of close contact with construction jobs.

Blaw-Knox Equipment is *dependable*—
It is properly *serviced*—it is *profitable* to use.

Visit Blaw-Knox at the ROAD SHOW

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MILAN, ITALY, 6 VIA S. AGNESE, 6
DUSSELDORF, GERMANY, 17 BISMARCKSTRASSE

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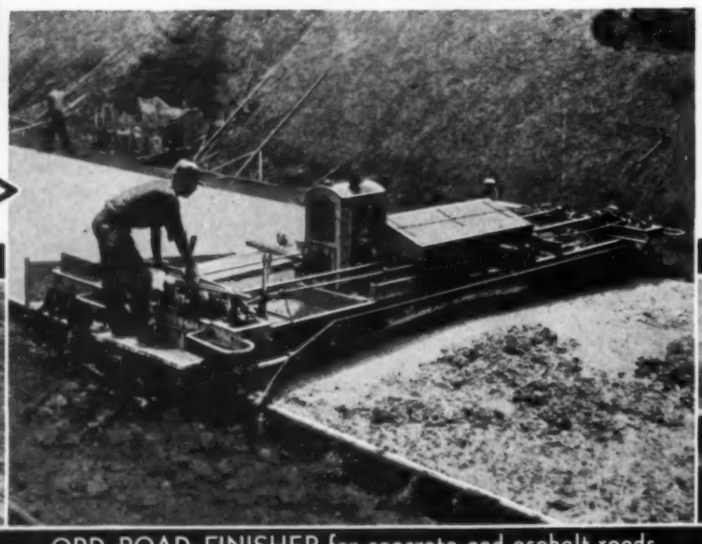


ORD ROAD FINISHER for concrete and asphalt roads

The Cementank

Weighing Batchers

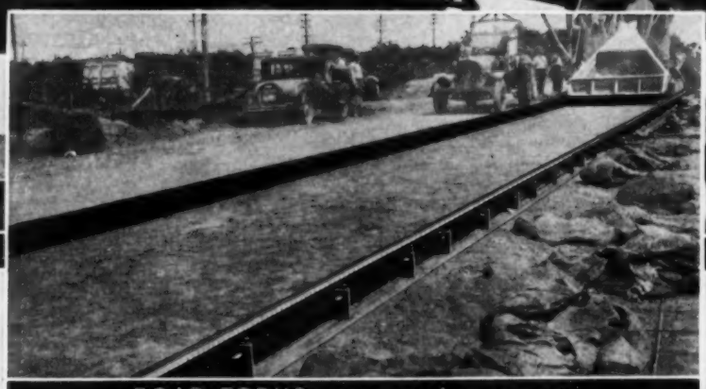
Agitator Truck Bodies

Clamshell Buckets - Draglines

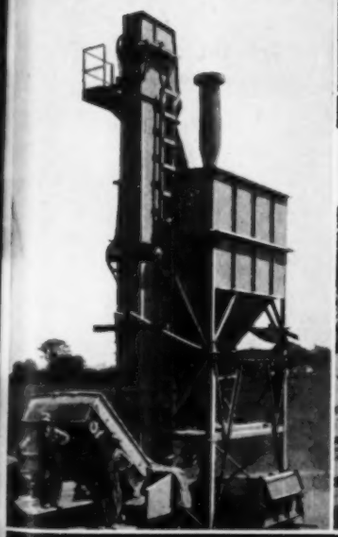
Truck Turntables

DEPENDABILITY

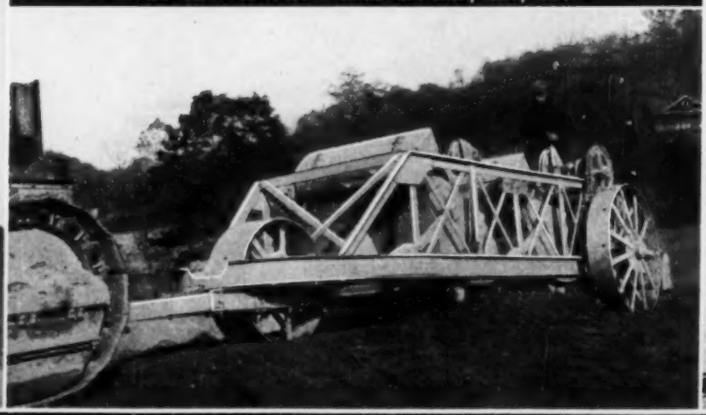
Batcherplants



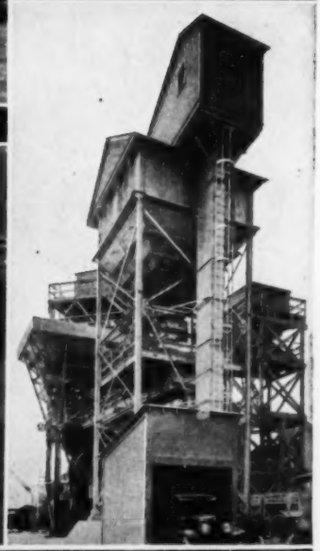
ROAD FORMS—once set they stay set



Bulk Cement Plants

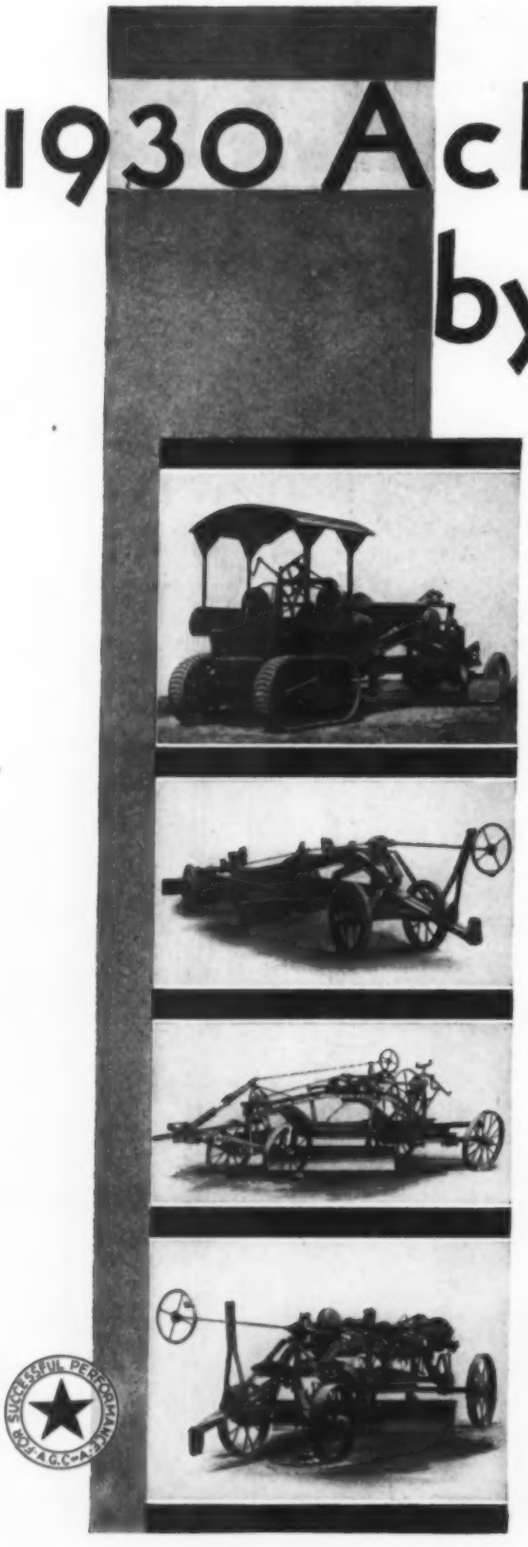


WAGON GRADERS—dig, load, haul, dump & spread



Ready Mixed Concrete Plants

1930 Achievements by GALION



1930 closed another Galion year of great achievements in road machinery history. Thus again, Galion maintains its reputation as the leading manufacturer of Road Machinery.

Outstanding among Galion 1930 developments are:

THE SURE-TRAC RUBBER CRAWLER — An improvement in Motor Grader construction which insures greater flexibility of operation, positive traction under any condition and more economical performance.

MULTIPLE BLADE ROAD MAINTAINER — A seven blade machine for leveling dirt, gravel, stone and retread roads. Passes material back and forth across a 9 foot cut four times in a single trip, insuring a thorough and even distribution of material.

No. 70 LEANING WHEEL GRADER (7 ft. moldboard) — A light, but sturdy leaning wheel grader of less than 4,000 pounds, for horse or tractor operation. Embodies all of the exclusive features of the larger Galion E-Z Lift Leaning Wheel Graders.

DUAL CONTROL MAINTAINER — A Grader and Maintainer in one machine. Operated from the tractor by means of the triple action gear shift it provides a one man maintainer. Operated from the rear it serves as a standard grader for road construction work.

These machines add many new advantages to Galion's modern road construction and maintenance machinery. We will be glad to send you catalogs covering the machines in which you are interested.

The Galion Iron Works & Mfg. Co.

Galion, Ohio

Galion Distributors

R. S. Armstrong & Bro. Co., Atlanta, Ga.
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If Your Demands Are Here . . . You'll Want To Know More About An Owen . . . .

If you want a bucket that will tackle every job you give it, and get through with it in the shortest time—

If you want a bucket that digs straight down, deep into the material, grabs a capacity load every time, dumps clean—with no waste motion—

If you want a bucket that does a "bigger day's work than any other bucket of the same weight and capacity" and that, assured by positive guarantee—

If you want a bucket that stands up under hard work with no breakage, and that gives longer life—

If you want a bucket that pays for itself in time saved and extra yardage—

You'll want an Owen—because Owen Buckets are making good in all of these requirements for satisfied owners, everywhere.

Jot down the particular kind of work a clamshell bucket must do for you and we'll send you some valuable data on the Owen that will pay for itself doing it for you.

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NEW! ????

To be announced at the Road Show

CLETRAC TWENTY

CLETRAC FORTY-THIRTY NEW!

CLETRAC FORTY

CLETRAC EIGHTY-SIXTY

At the

ROAD SHOW

you will find the Cletrac Exhibit in Building "A" in adjoining spaces 24 and 44, January 12 to 16, at St. Louis.

CLE

CRAWL

NEVER before in a single tractor line has there been offered so extensive an array of industrial power units as you find in the 1931 Cletrac line-up. With a power range up to a maximum delivery of 80 h.p. in the big 80-60, the line meets fully every power need in road and general contract work. Up-to-the-minute in every mechanical detail — rugged as tough steels and sound design can make them — dependably powered with the most modern of tractor motors — these Cletracs offer unquestionably the greatest values from which to select your 1931 tractor equipment.

— Automatic lubrication on all models

— Exclusive, patented planetary gear steering

— Remarkably low oil and gas consumption

See the Cletrac full line exhibit at the ROAD SHOW. The new smaller Cletrac with its marked advantages for small horsepower jobs — the new Cletrac "40-30" with its trim lines and superb performance — the Cletrac "20" — the old, trusty "40" — the incomparable "80-60" — all of these will be there to give you at first hand a complete picture of how Cletrac can serve you.

Literature on any or all models will be mailed on request.

The Cleveland Tractor Company

19323 Euclid Avenue Cleveland, Ohio

TRACTOR TRACTORS

THEW

A Size and Type Machine for Every Job

¾ — 1 — 1¼ — 1½ Yard
"Center Drive"
Shovels
Clamshells
Draglines
Backdiggers
Skimmers
Cranes

15—20—25 Ton
Locomotive
Cranes

Gas, Diesel, Electric

½ Yard
Universal Crawler Units

THE
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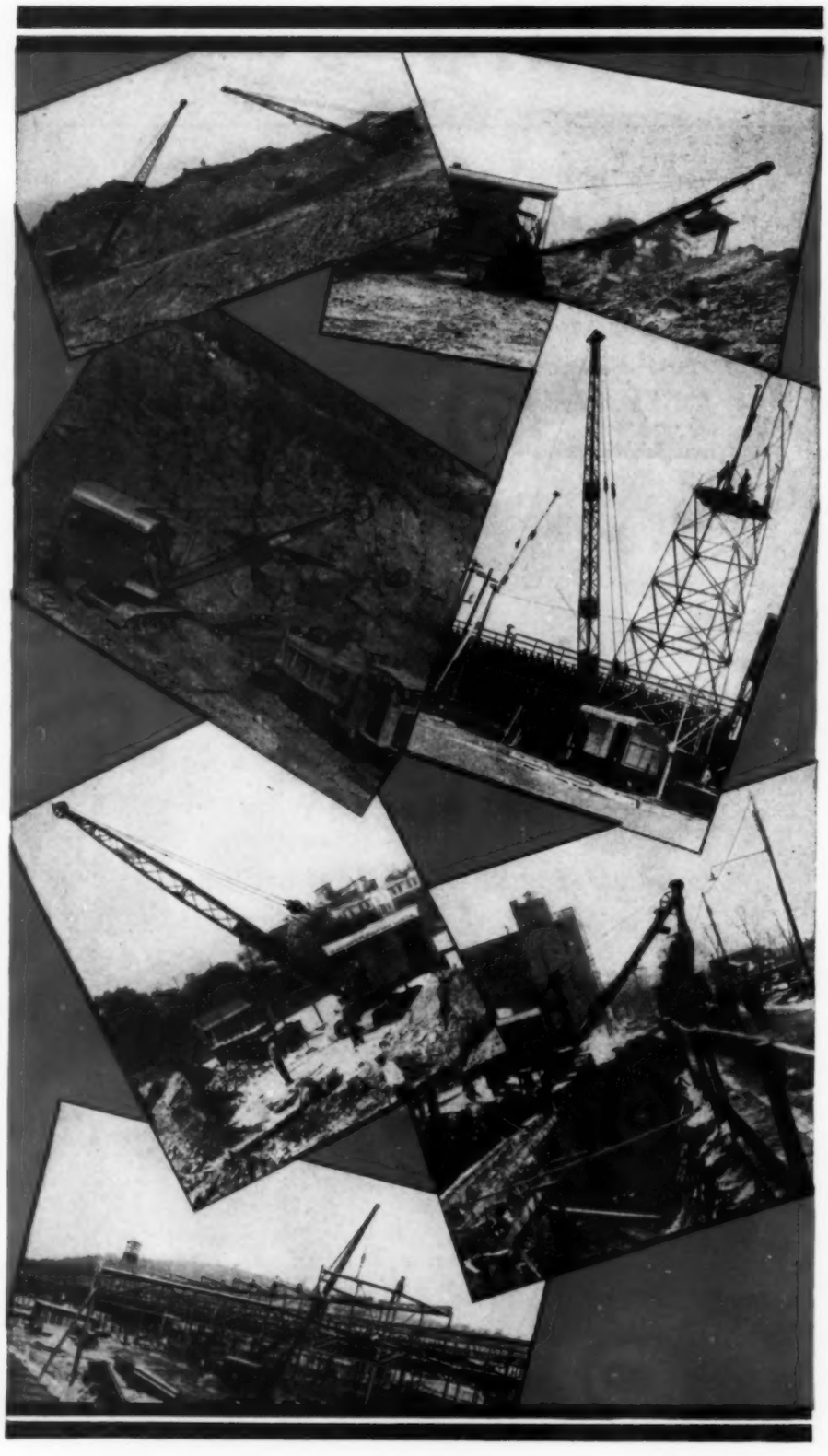


LORAIN

GRASS ROOTS to BEDROCK

FIRST the "Caterpillar" Tractors cleared away the trees and pulled the stumps — then they stripped the sod from borrow pits—the earth that went into this dam had to be free of foreign material. Then they hauled the earth to the dam site — then "Caterpillar" Sixtys with bulldozers spread the material and rolled it. Twelve "Caterpillars" speeded to early completion this job of the American Pipe and Construction Co. near Philadelphia.

Prices—f. o. b. Peoria, Illinois

TEN	$1100
FIFTEEN	$1450
TWENTY	$1900
THIRTY	$2375
SIXTY	$4175

Caterpillar Tractor Co.

PEORIA, ILLINOIS, U. S. A.

Track-type Tractors Combines Road Machinery

(There's a "Caterpillar" Dealer Near You)

CATERPILLAR
REG. U.S. PAT. OFF.
TRACTOR

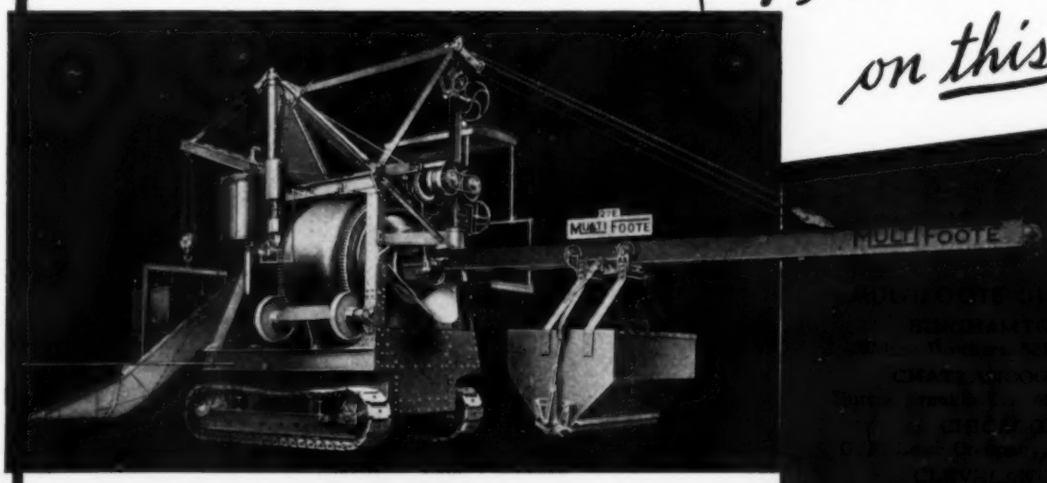
In 30 years of pioneering —

Foote introduced no less than 8 major construction principles in road paver design.

In 30 years of progress —

Foote has made hundreds of permanent friends evidenced by repeat orders for 3 — 5 — 10 up to 29 machines.

Swing your 1931 Profits on this boom



"Every Foote a Mixer"

And yet—

in 1931 we offer you a better Multi-Foote machine, a paver improved by still more refined engineering and materials, a paver capable of faster operation with safety, a paver backed up by a *service* which customers know cannot be measured by price.

If you are out for bigger and surer profits for 1931 now is the time to get the latest MultiFoote facts.

THE FOOTE COMPANY, INC., OF NUNDA, N.Y.

• • World's Largest Exclusive Builders of Road Pavers • •

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Steam Pumps, direct-acting, simplex and duplex; horizontal and vertical
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Power Pumps for gear, belt, motor or engine drive; vertical and horizontal; single, duplex and triplex cylinder
Centrifugal Pumps for belt, motor or engine drive; single and multi-stage; horizontal and vertical
Deep-well Pumps, reciprocating and rotary
AIR COMPRESSORS
Air Compressors, single or duplex cylinder, one, two, three and four stage; power, steam or oil engine drive, for air or gas service
Ammonia Compressors
STEAM CONDENSERS
Surface Condensers, Barometric Condensers, Jet Condensers
Condensing Systems, including all vacuum auxiliaries
Steam-Air Ejectors
FEEDWATER HEATERS
Locomotive Feedwater Heating Equipment
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For natural and blast furnace gas; power and compressing units; horizontal
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A new combined development by Worthington and Goodyear. Rubberized cord belts running in grooved pulleys, suitable for a wide range of equipment
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Plating of machine parts where resistance to wear, abrasion, corrosion or high temperature is important
Worthington patterns and products comprehensively cover the complete range for each line of manufacture, as well as the special service requirements of each industry
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Powerful, Sturdy, Compact

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- ☐ W-1208-S1—Pavement Breakers
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AGAIN the Worthington symbol of service spreads its wings . . . taking in another family of products to round out even more effectively Worthington's service to Industry.

Under the name Worthington-Gilman is grouped a complete line of rock drilling equipment and accessories covering every rock drilling need. In addition to proven performance ability, this equipment possesses characteristics not found in other drills. The basic units, when combined with interchangeable parts designed for varying uses, make up a wide range of equipment . . . providing a flexibility which meets changing requirements with a minimum investment.

This line includes forging furnaces and automatic heat-treating machines for drill steel . . . equipment which assures the highest effectiveness and longest life for the steel.

To the recognized excellence of the advanced Gilman design and construction, Worthington has added its extensive experience and manufacturing facilities . . . plus a nation-wide distributing organization, including twenty-four district offices, adequate dealer representation and equipment stocks at strategic points. Further, there has been placed upon this line the guarantee of satisfactory performance which is inherent in the Worthington and Gilman names.

Clip and mail now the coupon on the opposite page, requesting the material which applies to your field.

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T-2

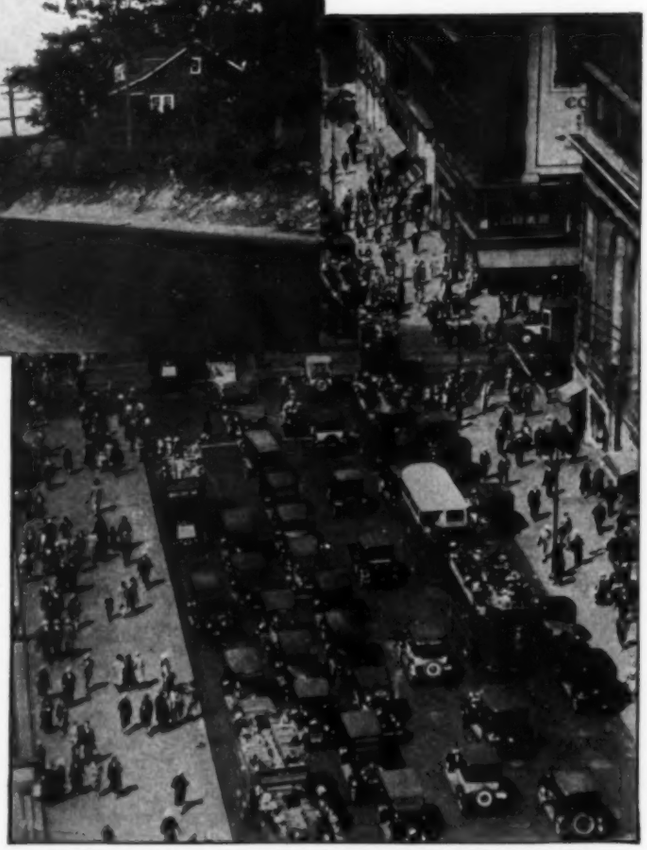
WORTHINGTON

Pave and Save with ASPHALT

NEWBURYPORT TURNPIKE IN EASTERN MASSACHUSETTS
An old asphalt macadam pavement was widened on this portion with penetration macadam base and same type of surface. This road was built in 1922 and widened in 1928.

The Asphalt Institute presents as a sound highway program for 1931 the following basic considerations:

1. The surfacing of a large mileage of farm-to-market roads to connect with main highways.
2. The widening of present inadequate pavement widths by economical methods.
3. The waterproofing of earth, gravel and stone shoulders.
4. The general adoption of stage or progressive construction coordinated with traffic needs.
5. Full utilization of existing pavements or surfaces as bases for new wearing courses.
6. Waterproofing subgrades preparatory to laying new pavements or surfaces, irrespective of type.
7. Avoidance of dangerous and inadequate *one lane* pavements on *any* highway.
8. Confining gasoline taxes strictly to highway purposes.



FIFTH AVENUE AND 42nd STREET, NEW YORK CITY
—carrying the heaviest traffic of any street intersection in the United States. The asphalt pavement at this point carries a traffic upwards of 50,000 vehicles per day.

The Asphalt Institute invites inquiries for information as to practicable means of accomplishing these objects.

The ASPHALT INSTITUTE

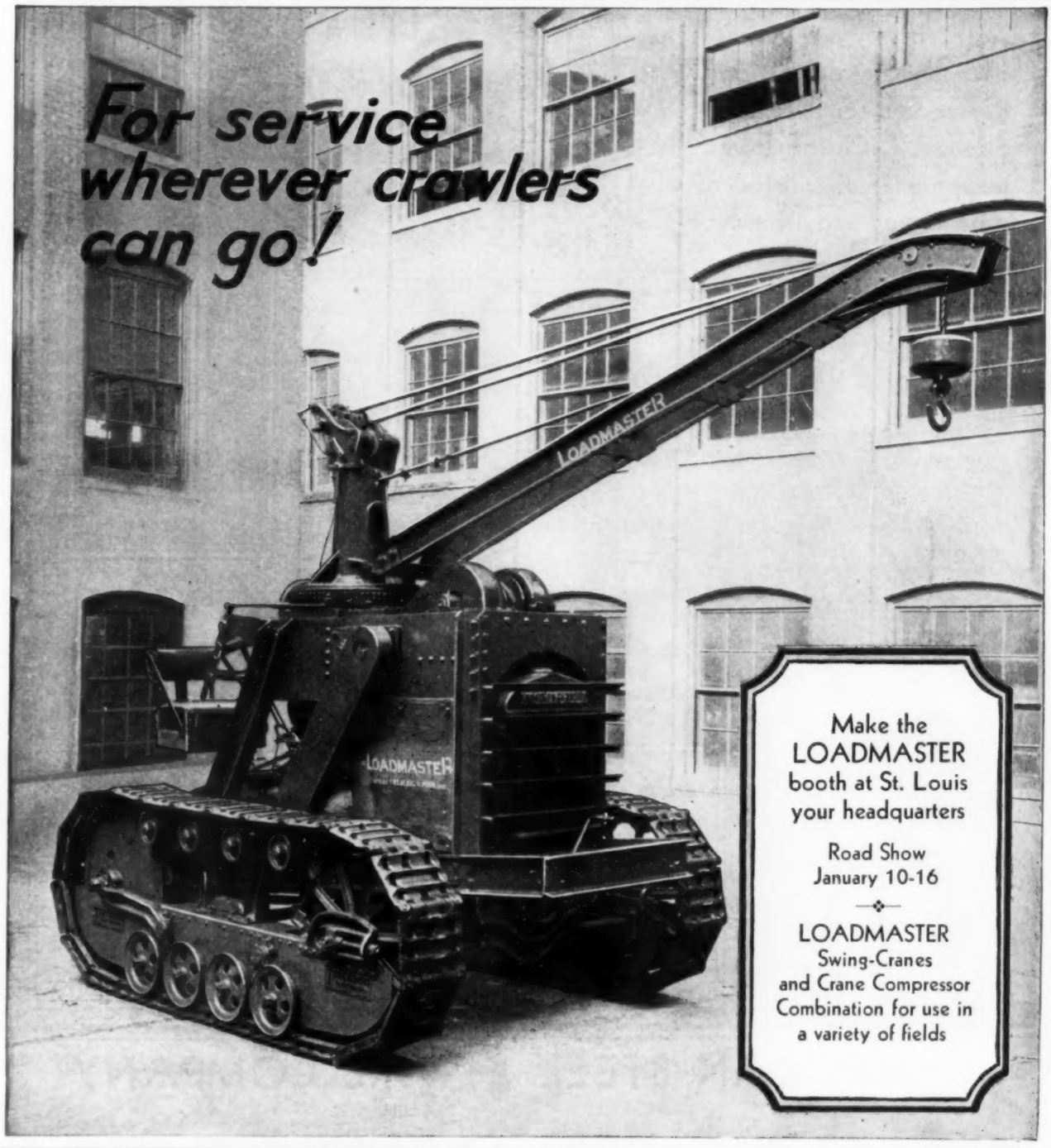
A national institution not organized for profit but for constructive, educational and research activities. Representing 85% in volume of the asphalt producers in the United States and Canada.

801 SECOND AVENUE (at Forty-third Street), NEW YORK, N. Y.

Visit the Asphalt Institute Booth No. A-125 at the Road Show.

LOADMASTER

SWING – CRANE



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Road Show
January 10-16

LOADMASTER
Swing-Cranes
and Crane Compressor
Combination for use in
a variety of fields

FREDERIC H. POOR Inc.

342 Madison Ave.
New York, N. Y.

STRENGTH

SO MUCH depends on safety, especially in congested city areas, that surplus strength has been built into American Wire Rope. Our engineers are at your disposal. Let them help you select the proper construction of wire rope for your requirements.

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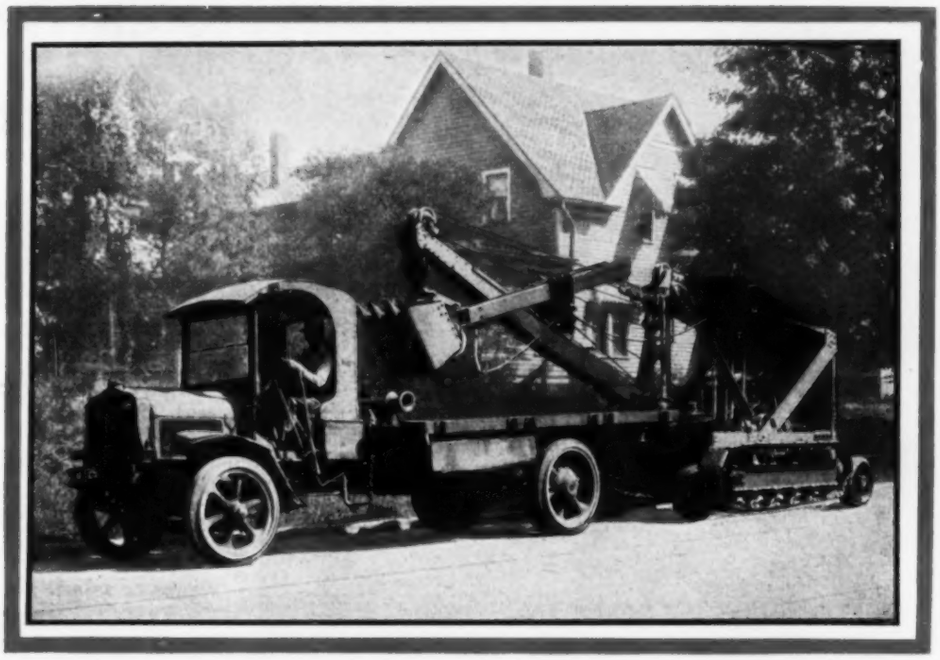


Mounted on its own trailer Byers' Excavator *reduces hauling costs*

ARE you one of the Contractors who pay $1500.00 or more per year hauling small shovels from job to job?

You can reduce your Shovel or Crane hauling costs and *put the extra savings in the bank.* Determine to spend one-half as much in 1931 for hauling costs as you spent in 1930—the BYERS' Excavator, *mounted on its own trailer,* will help you.

Extra profits, speedy mobility, no waiting for a rented trailer to pick up your rig—these and many other reasons should help you decide that your next less than ½ yard Shovel or Crane will be a BYERS' Excavator.

Ask to see Excavator literature. We'll be glad to send you trailer information with it.

THE BYERS EXCAVATOR CO., RAVENNA, OHIO

BYERS EXCAVATORS

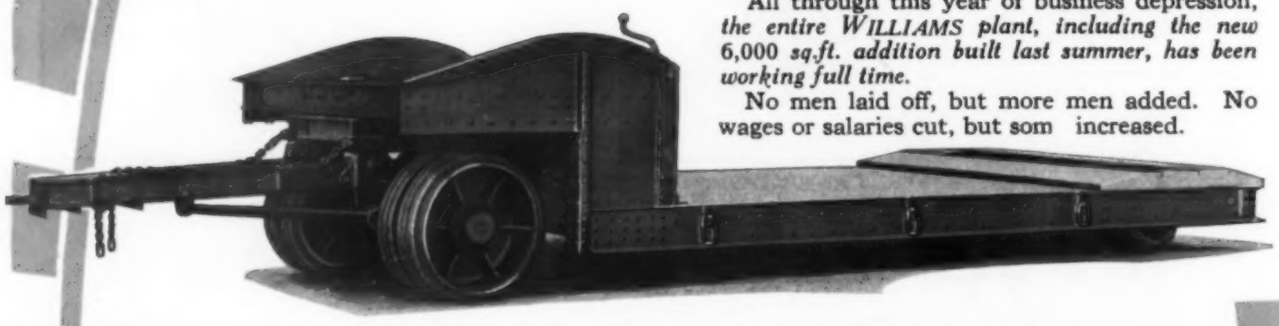
10 CU. FT. STRUCK MEASURE, 1/2 YD. USUAL FILL

Buyers can always appre cia
better values, which ex
WILLIAMS' BIG G

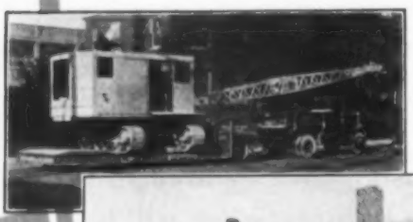
— with Bucket sales ahead of 1928 and '29— and Trailer sales *more than double what we had estimated.*

All through this year of business depression, *the entire WILLIAMS plant, including the new 6,000 sq.ft. addition built last summer, has been working full time.*

No men laid off, but more men added. No wages or salaries cut, but som increased.



The original Trailer developed to give *increased pay-load capacity - - -* Greater strength, without increased weight



Contractors everywhere are selecting WILLIAMS Trailers because of the improved design that gives *bigger pay load capacity.* Look this trailer over at Booth A-52.

YOU'LL know why the sales of this *modern* trailer were more than double our estimate, when you look over at the Show.

"SHOCK-PROOF" REAR END, with rigid cast-steel frames carrying the rear wheels in pairs. Each frame is free-swiveling, keeping the trailer's load evenly distributed. Plenty of clearance— *wheels cannot jam against the bridge.*

STRONGER FRONT END—the deep "arch girder" is reinforced by sturdy stiffeners; no buckling.

EASIER TO LOAD, because the loading point is about 6 inches lower. Shorter skids can be used. Saves time and labor in blocking up— saves loading space.

EASIER RUNNING— EASIER TO STOP. Your truck uses less gas to pull a WILLIAMS Trailer, because every wheel turns on big over-size Timken Bearings. Four big brakes, operated by a ratchet handle of the street railway type. (Air or "booster" brakes can be furnished.)

G. H. WILLIAMS
ERIE,
Branch Offices: NEW YORK,

WILLI
TRAILERS — BU

ciate *better equipment* and explains why 1930 was—

GEST YEAR !

You'll understand the phenomenal increase in sales of WILLIAMS "Champion" Buckets and WILLIAMS "Arch-Girder" Trailers, when you inspect this EXTRA-PROFIT equipment at the Road Show. Contractors everywhere have recognized the *higher efficiency* and *better value* of WILLIAMS buckets and Trailers.

Proven and Guaranteed to be the most powerful digger built

The WILLIAMS "Champion" gives you unequalled capacity —and lower cost

NEVER have you seen a bucket to equal the WILLIAMS "Champion" for *digging power and speed.* This super-bucket has been rated by contractors as "in a class by itself for hard digging."

You'll find improvements all over it. And the unique tandem arrangement of sheaves, on the WILLIAMS Power Arm, makes a *straight line* closing pull possible and conserves the power for actual digging.

Try it on your work— make any tests you want. The "Champion" sells itself by *better performance.*

If you are not planning on going to the Road Show this year, drop us a line for our new descriptive bulletins on the 1931 WILLIAMS "Arch-Girder" Trailer and the new 1931 WILLIAMS "Champion" Bucket.

Inspect the most powerful digger built— at Booth A-52. You'll understand why contractors rate the WILLIAMS "Champion" as *without an equal for digging power and speed.*

COMPANY
PENNA.
PITTSBURGH, CHICAGO

IAMS
—BUCKETS

259

Lubrication that Reduces Costs . . . . . GREDAG

REG U. S. PAT OFF

LUBRICANTS

GREDAG lubricants were developed to successfully meet the most difficult problems of lubrication. They have proved their ability to reduce cost of lubrication and maintenance under the most severe conditions.

Very fine, *pure,* electric furnace graphite is uniformly blended with a high quality grease, each particle of graphite separately supported in the soft grease lubricant. The graphite particles are so fine that they remain evenly distributed in the thinnest film of lubrication.

Electric furnace graphite is free from mineral impurity and is itself a good lubricant. Properly blended with a suitable grease, it forms a product greatly superior to either constituent alone.

The fine particles of graphite form a graphite-filled bearing surface that will not score or seize. This graphitic surface is more readily wet by grease than is plain steel or bronze—a fact which insures an adhering film of lubricant under the heaviest of bearing pressures.

There is a grade of GREDAG for every class of lubrication service—either protected or exposed.

INSURED LUBRICATION *for*

Bearings · Gears · Chains · Cables · Plungers · Guides

NATIONAL CARBON COMPANY, INC.

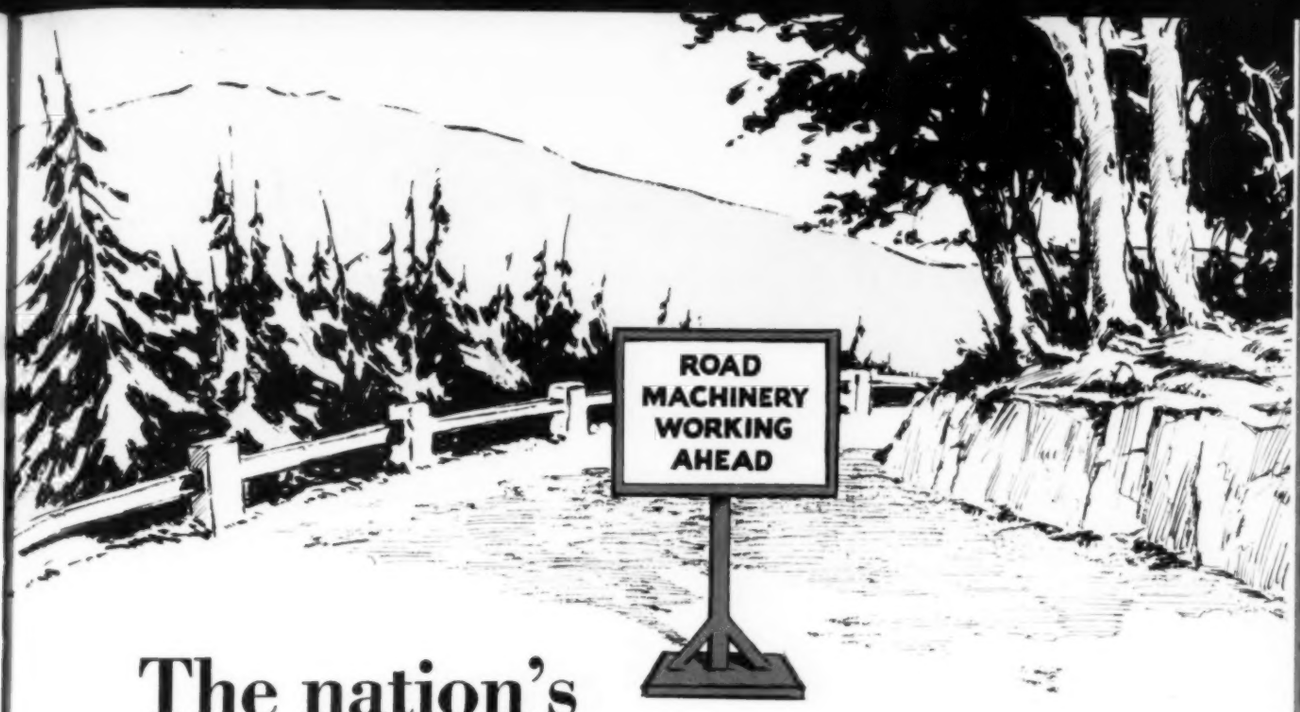
Carbon Sales Division

CLEVELAND, OHIO

Unit of Union Carbide and Carbon Corporation

Branch Sales Offices

NEW YORK · PITTSBURGH · CHICAGO · SAN FRANCISCO



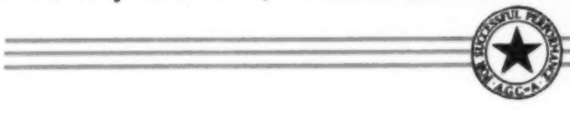
The nation's highways are our laboratories!

MANY a contractor, many civil officials, many an engineer faces the present gigantic task imposed by the greatest road improvement program in all history, with the assurance that efficient tools are available—competent for the project.

In the field of roadworking equipment, too, has taken place the substitution of machines for hands—and then the competition of machine against machine in the battle to lower road improvement costs.

In 1858 the first Austin road scraper went to work on American highways. Little more than a graded lane sufficed for the animal-drawn traffic of that day and that of later years. Yet, even then were learned lessons in roadworking methods and design of equipment which enabled Austin-Western to meet the new era of high speed motor travel and place in the hands of modern trailmakers machinery adequate to the new demands.

Thus, for 71 years Austin-Western have perfected their products on the nation's highways. Austin-Western improvements in equipment have been not only *salable* but *usable*—because above all else, they have been *practical*. In their factories, Austin-Western Engineers are building equipment based upon the lessons of the road. Austin-Western never intends to lose the *practical* touch in pursuit of theoretical perfection.

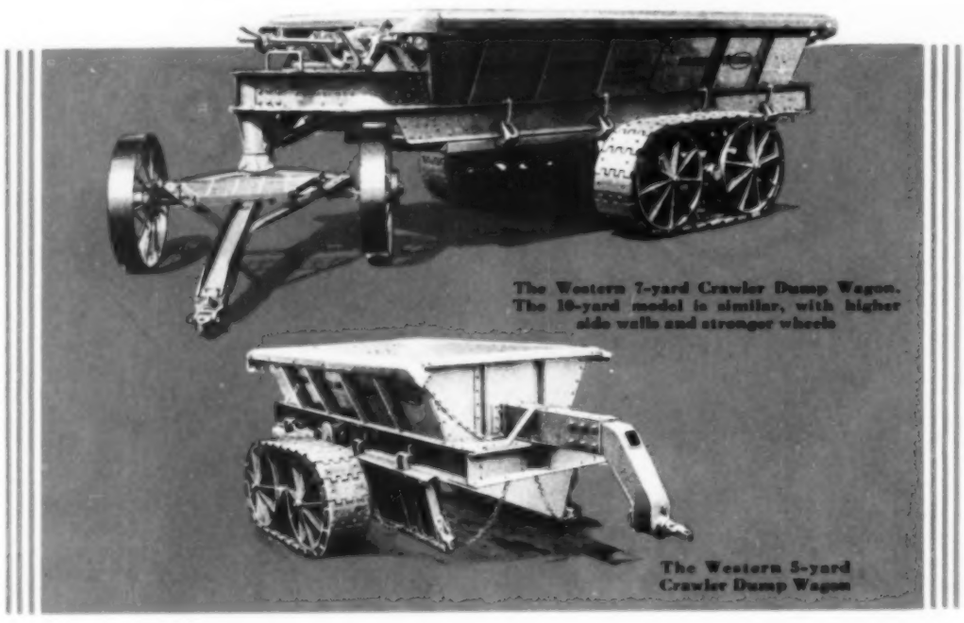


Austin-Western
ROAD MACHINERY

AUSTIN-WESTERN ROAD MACHINERY-COAST TO COAST

Western Crawler Dump Wagons

take the "grief" out of the hardest earth handling jobs



The Western 7-yard Crawler Dump Wagon. The 10-yard model is similar, with higher side walls and stronger wheels

The Western 5-yard Crawler Dump Wagon

WESTERN CRAWLER WAGON loading with an elevating grader—*the cheapest known method of moving dirt*. Unsurpassed for street excavations—levee or railroad embankment building

THE AUSTIN CONTRACTOR'S SPECIAL ELEVATING GRADER with or without Power Take-Off provides maximum strength, capacity and durability for modern earth moving requirements

THE WESTERN LEVEE SPECIAL ELEVATING GRADER with engine-driven belt has a greatly increased capacity. Other features are: a new elevator, tongue and redesigned frame

THESE crawler wagons with Athey Truss Wheels will go, heavily loaded, wherever a tractor can lead. The 7 and 10 yard sizes are designed to operate behind the most powerful tractors. With their huge loads equal to many ordinary dump wagons carried almost entirely on the rear crawlers—they are the most effective means yet devised for keeping down earth handling costs.

Where the most powerful tractors are not available, there is the 5-yard Western Crawler Wagon with all the features of the larger models except the front wheels. In the 5-yard, the entire load is carried and balanced on the Athey Truss Wheels.

These wagons are sturdily built to stand loading by steam shovel or elevating grader.

THE AUSTIN-WESTERN ROAD MACHINERY CO.

400 North Michigan Avenue « **CHICAGO, ILLINOIS** » *Branches in principal cities*

Leaning Wheel Graders, Straight Wheel Graders, Motor Graders, Elevating Graders, Crawler Dump Wagons, Scarifiers, Rock Crushers, Portable Conveyors, Rollers, Motor Sweepers, Street Sweepers, Sprinklers, Road Oilers, Hot Patch Portable Asphalt Plants, Plows and Scrapers.

THIRTY-SIX PLYMOUTHS HAVE HELPED BUILD WAYNE COUNTY MICHIGAN ROADS

Having carried on a consistent road building program for the past eighteen years, the Wayne County Road Commissioners have developed one of the largest road building organizations in the world.

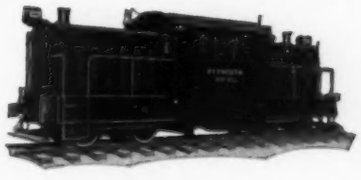
Their building program has averaged fifty miles of new roads each year in the past six years—mostly hard surface roads, and nearly all twenty feet wide. This is in addition to replacements, repairs and the widening of an average of twenty miles of old roads per year.

Thirty-six Plymouth Gasoline Locomotives have reduced their haulage cost and increased their yearly mileage by placing materials on spot, rain or shine.

PLYMOUTH LOCOMOTIVE WORKS
THE FATE-ROOT-HEATH CO
PLYMOUTH, OHIO

PLYMOUTH

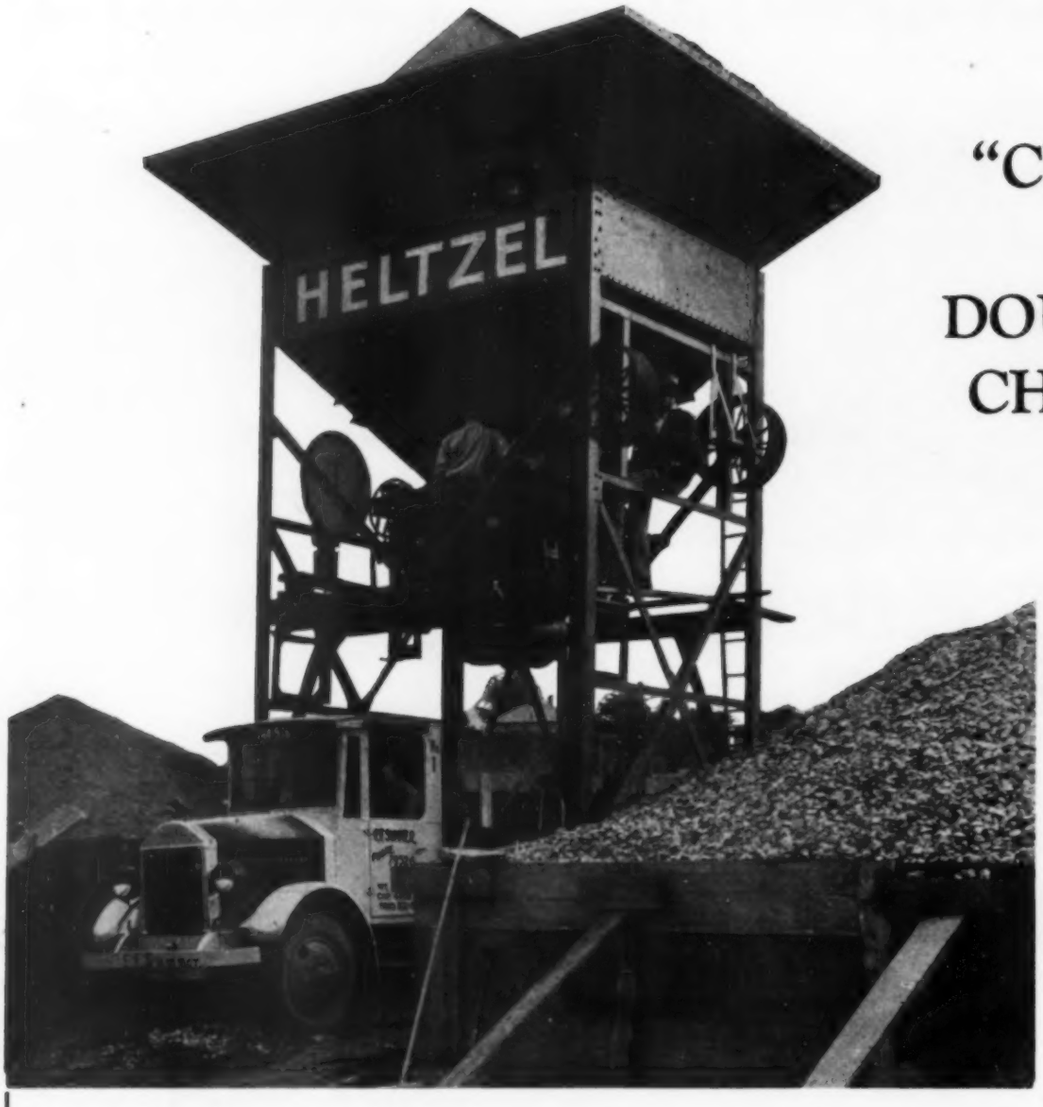
If it's a Track Haulage Problem There's a PLYMOUTH to Solve it



The PLYMOUTH 60-ton Diesel locomotive specially built for heavy hauling and shifting.

PLYMOUTH

Gasoline and Diesel Locomotives



"CHECK AND DOUBLE-CHECK"

IT'S EASY WITH THE HELTZEL WEIGH-ING PLANT

AT ST. LOUIS

the Heltzel Exhibit will be located in Space AR-12. In addition to Superior Lock Road Forms there will be a complete exhibit of other Heltzel equipment.

To weigh a batch the Heltzel "weigh,"—just watch the dial and fill the hopper. It is not necessary to balance any beams or watch a second pointer.

To back-check a batch, merely glance at the dial after the batch has been discharged from the weigh hopper. There are no poises or counter balances to set—the springless dial scale used by Heltzel is automatic in action.

Write today for complete information on this modern weighing plant.

The HELTZEL STEEL FORM & IRON CO.
WARREN, OHIO

HIDDEN WITHIN ITS WALLS
A CONTRIBUTION TO BETTER CONSTRUCTION BY

Sterling
WHEELBARROWS

PALMOLIVE BLDG.
CHICAGO
LUNDOFF-BICKNELL CO.
GENERAL CONTRACTORS

IT is the Wheelbarrow which is the pacemaker on any job. If they fall down they cause delay and expense. If they stand up under hard service they speed up production.

The stability of the "Sterling" is the reason for their preference.

Buy Sterlings for the economies they create.

Branch offices and warehouses at Boston, New York, Philadelphia, Pittsburgh, Cleveland, Detroit, Chicago, St. Louis.

MANUFACTURED for the EUROPEAN MARKETS BY
STERLING FOUNDRY SPECIALTIES Ltd
STERLING WORKS
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STERLING WHEELBARROW COMPANY

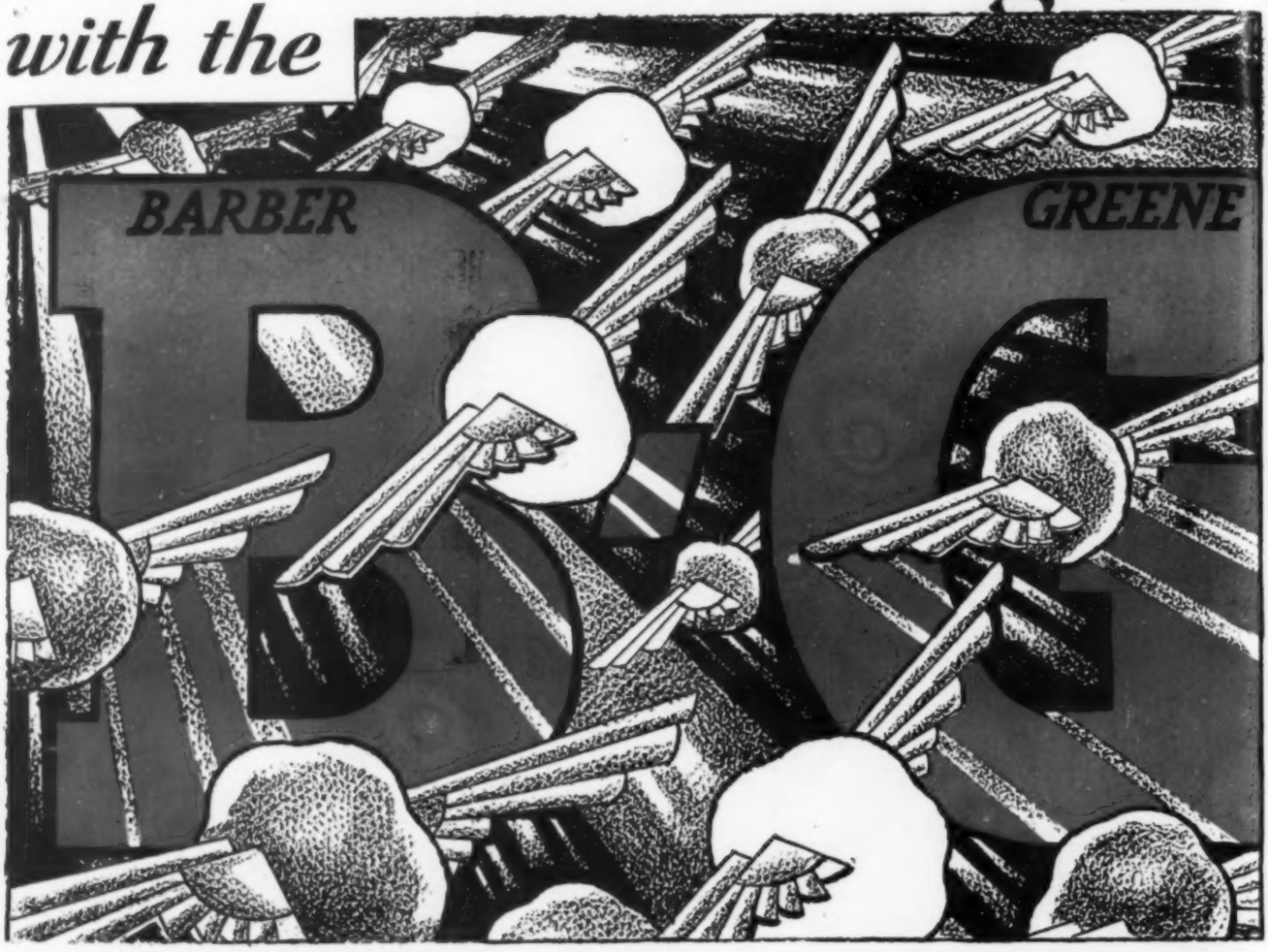
STERLING ON A WHEELBARROW MEANS MORE THAN STERLING ON SILVER

Milwaukee

MANUFACTURED FOR THE EUROPEAN MARKETS BY:—
STERLING FOUNDRY SPECIALTIES Ltd STERLING WORKS, BEDFORD, ENGLAND

Wisconsin

Wings to Stone and Other Things *with the*

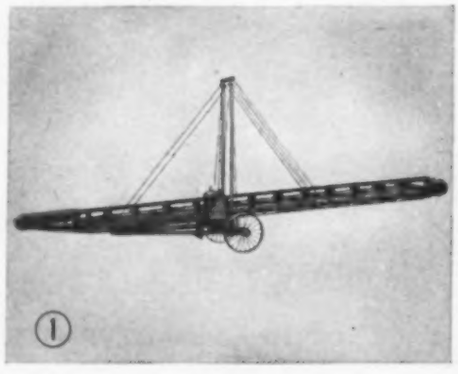


1 Barber-Greene Portable for handling wet concrete or any bulk materials.

2 Barber-Greene Portable and Belt Car Unloader unloads aggregates from hopper cars.

3 The New Barber-Greene Model "62" Loader—62 cu. ft. per minute. Can be had with weigh hopper or high frequency vibrating screen.

4 Barber-Greene Permanent Conveyor built up of standardized frame sections.



BARBER

STANDARDIZED MATERIAL HANDLING MACHINES

530 West Park Avenue

A Basic Material Moving Principle . . . the Stream that Almost Flows by Itself . . . . . .

The Barber-Greene Idea is a basic bulk material handling principle that swells yardages and cuts costs on unloading, storing, reloading and similar jobs.

The Barber-Greene Idea approaches, very closely, the ideal of making stone and similar things fly from where they are to where you want them.

A simple continuous belt or bucket line is the only basic material moving machinery.

There is no staggering number of pounds to be moved with the material—and there is no complicated heavy gearing, no tons of castings, no huge, gas-gobbling horse-powers.

Material movement is simple, direct, in a fast-moving stream—that almost flows by itself.

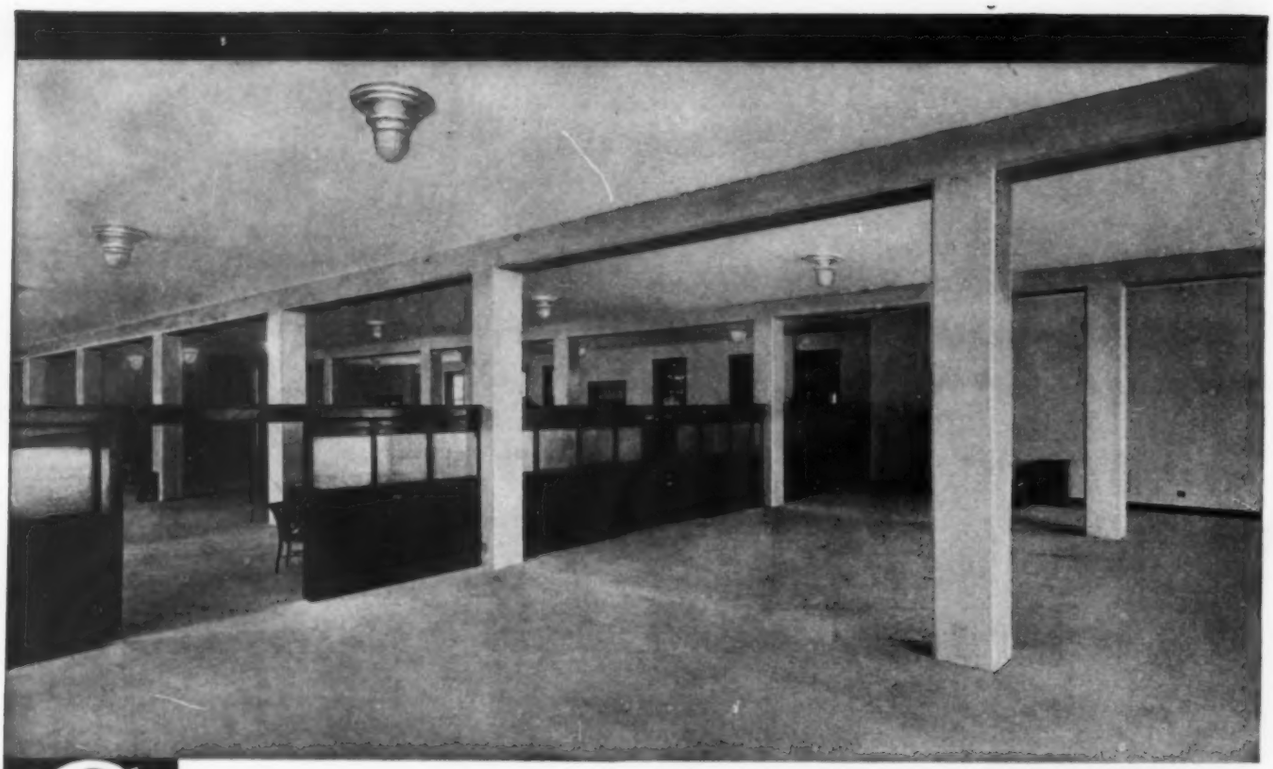
Such basically simple machines can be finely engineered and finely built—at prices far, far below these other methods. And constant application of Barber-Greene Idea has developed a line that meets practically any material moving application.

Ask for the Barber-Greene Line Book. It indicates possible savings that Barber-Greenes can effect for you.

GREENE

Standardized Belt Conveyors — Portable Belt Conveyors
Portable and Self-propelled Flight Conveyors
Self-propelled, Self-feeding Bucket Loaders
Flight and Belt Car Unloaders — Snow Loaders
Light and Heavy Duty Ditchers

Aurora, Illinois



Concrete columns and floors at the newly remodeled Saddle & Sirloin Club, Chicago; high-early-strength concrete made with Universal Atlas methods and cement used in the construction. Poirot Construction Co., Chicago, contractor.

Saving time and materials

with *Universal Atlas* high-early-strength concrete

● ● ● The high-early-strength concrete used in remodeling the Saddle and Sirloin Club, Chicago, permitted the removal of alternate rows of shores five days after the concrete was placed. This is much sooner than is practicable with concrete made by ordinary methods. Not only was time saved but equipment also. Shores that were removed at the five-day periods were immediately available for use on other sections of the work. This permitted the contractor to cut down on the equipment required for the job.

● ● ● High-early-strength concrete made with Universal Atlas methods and cement (the same Universal Atlas standard portland cement as furnished for regular work) is stronger, more durable and more watertight than ordinary concrete. Send for booklet containing these methods for saving time and securing improved concrete. . . . . .

45

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NEW YORK
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Universal Atlas Cement Co.

Subsidiary of United States Steel Corporation

Concrete for Permanence

MINNEAPOLIS
DULUTH
ST LOUIS
KANSAS CITY
DES MOINES
OMAHA
OKLAHOMA CITY
BIRMINGHAM
WACO

Construction Methods

A McGRAW-HILL PUBLICATION—ESTABLISHED 1919

ROBERT K. TOMLIN, *Editor*

VOLUME 13 NEW YORK, JANUARY, 1931 NUMBER 1

Strikeoff Pulled by Power From Paver

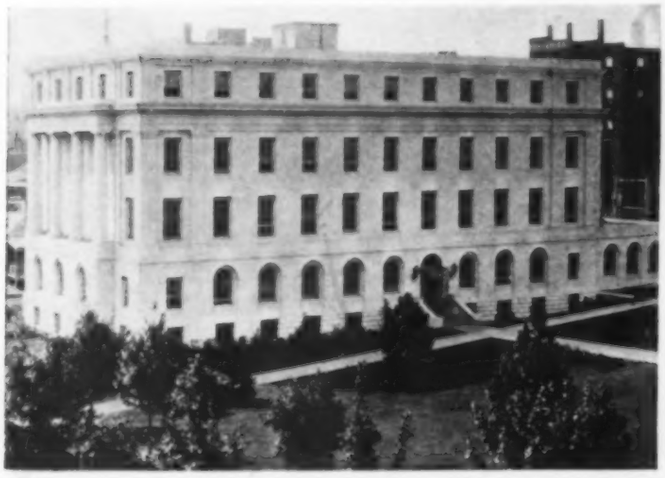
AS A preliminary to the placing of steel mesh to reinforce road slabs in Pennsylvania, the surface of the concrete is leveled off at the proper elevation by a mechanical strikeoff pulled by power from a takeoff on the paving mixer. The strikeoff illustrated herewith is a home-made affair of wood with its ends sliding on the forms. Several manufacturers, however, are placing on the market a steel templet cut to proper cross-section and equipped with wheels for operating on the tops of the forms. Paving mixers, too, are now being equipped with the necessary power takeoff for operating mechanical strikeoffs of this type.

MECHANICAL STRIKEOFF is pulled by cable from power takeoff on mixer. Ends of templet ride on road forms.

Experience in Pennsylvania, as recited by W. A. Van Duzer, assistant chief engineer, indicated that much time was lost when the strikeoff operations were performed by hand to bring the concrete to an even surface 2 in. below the top of the finished pavement to receive the reinforcement. With the present method and a mixer operator skilled in placing the concrete batches, the mechanical strikeoff can be depended upon to spread the mixture evenly to the proper elevation at a substantial saving in time and in manual labor.

CONCRETE SURFACE *(above)* is brought to uniform level 2 in. below pavement top. STEEL REINFORCEMENT *(right)* is then placed at proper elevation and covered over with top course of concrete.

This Month's NEWS REEL

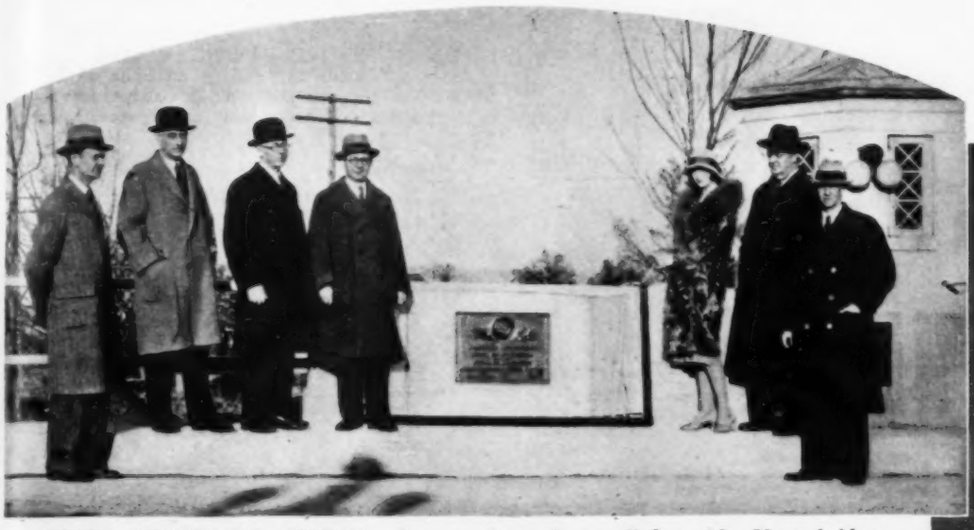


MISSOURI HIGHWAY HEADQUARTERS. New office building adjoining State Capitol at Jefferson City, Mo., has recently been completed at cost of $350,000 to house the various departments of the state highway commission.

ROADWAY for Hudson River bridge, connecting New York and New Jersey, is now partly completed. View shows deck supported by cables from 3,500-ft. main suspension span.

FOREIGN ENGINEERS *(left)* inspect bituminous laboratory exhibits of U. S. Bureau of Public Roads at Arlington during recent International Road Congress.

NEARLY READY FOR TRAFFIC. Construction is almost finished on the memorial bridge across the Potomac River connecting Washington, D. C., with Arlington Memorial Cemetery. Lift spans open at main channel.



PRIZE AWARD FOR BRIDGE. Bronze plaque is unveiled at Mt. Hope bridge, Rhode Island, chosen by American Institute of Steel Construction as most beautiful long-span bridge erected in 1929. Designers, Robinson & Steinman; contractors, McClintic-Marshall Co.

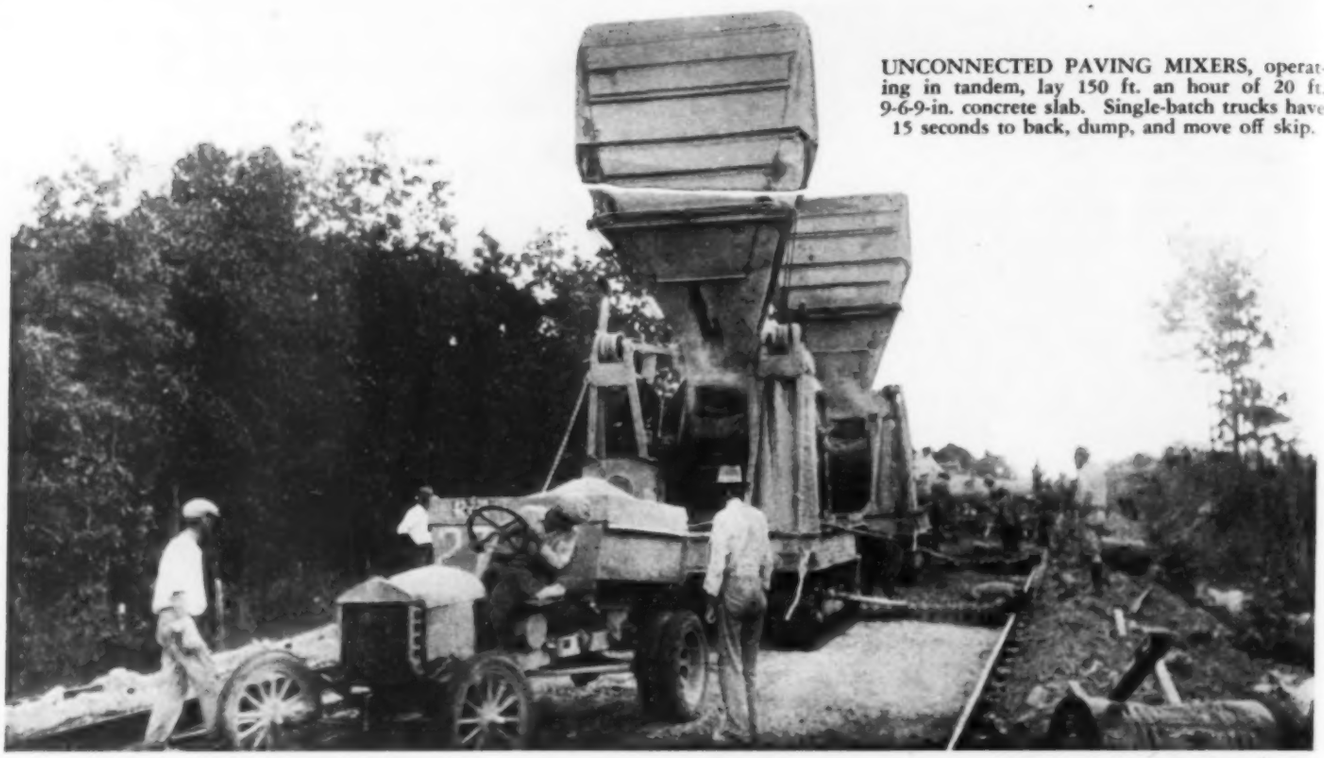
TOPPED BY MOORING MAST for dirigibles, 85-story Empire State Building, New York, world's tallest structure, towers 1,248 ft. above street level.

©R. I. Nesmith

NEW RAILROAD LINE, 112 miles long in northern California, will connect Western Pacific and Great Northern railways. Contractors, W. A. Bechtel Co., San Francisco, and Utah Construction Co., Ogden, Utah. Project includes twelve tunnels.

©Wide World

ELEVATED EXPRESS HIGHWAY along west side waterfront, New York, is opened to traffic between Canal and 23rd Sts. Steel structure, built by James Stewart & Co., Inc., has roadway carrying six lanes of traffic.



UNCONNECTED PAVING MIXERS, operating in tandem, lay 150 ft. an hour of 20 ft. 9-6-9-in. concrete slab. Single-batch trucks have 15 seconds to back, dump, and move off skip.

TWO PAVERS IN TANDEM

Make Progress 60 Per Cent Greater Than Single-Mixer Outfit

TWO unconnected paving mixers operated in tandem, each doing approximately half the mixing of every batch, attained a production 60 per cent greater than that reached by either when operated alone on a 38½-mile concrete road job between Springfield and Louisburg, Mo., built during the 1930 season by the Hoeffken Brothers' Construction Co., of Belleville, Ill. Change from the single-paver to the tandem-paver outfit required, in addition to the second mixer, an extra material-handling crane, a 60 per cent increase in batch trucks, and

AFTER 35 SECONDS IN DRUM, first paver discharges batch, through bucket traveling on boom, into skip of second mixer. Batch appears dry after short mixing period, as water is not yet thoroughly worked into mixture.

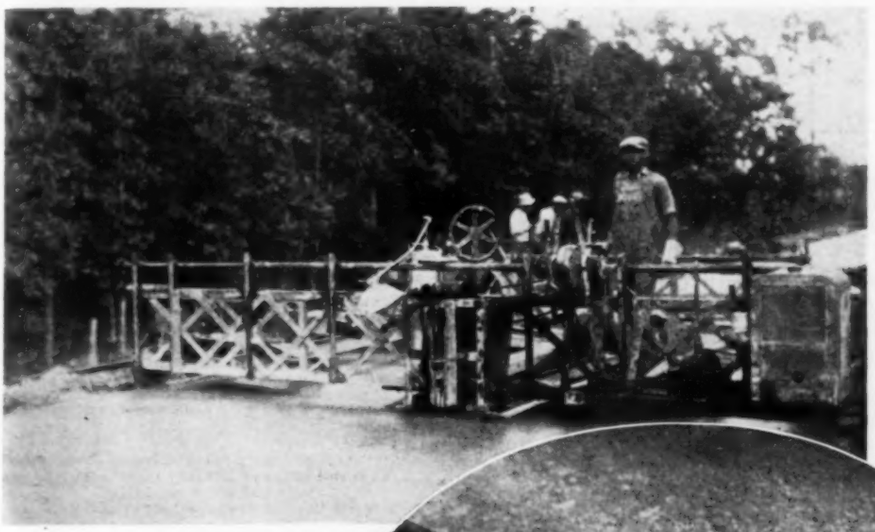
WHEN SECOND PAVER DUMPS BATCH ON SUBGRADE, 40 seconds' additional mixing has greatly improved workability of concrete. Pins support dowel rod beneath center-line joint.

a 20 per cent larger working force.

Job Conditions—As the contractor used both kinds of outfits on the same contract under similar conditions, the results obtained give a good measure of comparison of the two methods. Aggregates were stored in five stock piles along the 38½-mile route by M. E. Gillioz, of Monett, Mo., operating under a separate contract. The Hoeffken Brothers' Construction Co. hauled cement from two railroad sidings, both of which were a long average distance from the portion of the job served.

All parts of the job were relatively uniform as to grade and alignment. The highway traverses rolling country and has a maximum grade of 6 per cent and only four widened curves, the extra width amounting to 3 ft. Normally the road is 20 ft. wide, with a 9-6-9-in. cross-section. The 9-in. thickened edge is 2 ft. wide and reduces to 6 in. in the next 2 ft. On all grades, Missouri uses the Iowa development of a lip curb to prevent run-off from eroding the shoulders. The lip curb, cast integrally with the pavement, is 3 in. high by 12 in. wide. A flat top 3 in. wide tapers to the pavement surface in 9 in. Area of the cross-section without curb is 11.5 sq.ft.; with curb, it is 11.81 sq.ft.

Progress Records—The two single-paver outfits constructed the first 26½ miles; they were combined into the tandem outfit for the last 12 miles. For a single mixer, the average run was 90 ft. an hour; the best day's progress was 1,492 ft. in 13½ hours. The tandem outfit demonstrated an ability to average 150 ft. an hour, making 1,882 ft. in 12 hours 35 min., and 950 ft. in 6 hours 20 min. These runs were typical of days when the trucking service was adequate to keep the mixers working at capacity. The newness of the tandem-paver arrangement and the occasional breakdowns of trucks which already had hauled batches for 26½ miles of concrete sometimes caused derangement of the trucking schedule.



MOTOR-DRIVEN MACHINE for installing contraction joints cuts center-line slot as it moves forward. **PREMOLDED JOINT MATERIAL** *(in oval)* is fed into center-line slot in continuous ribbon.

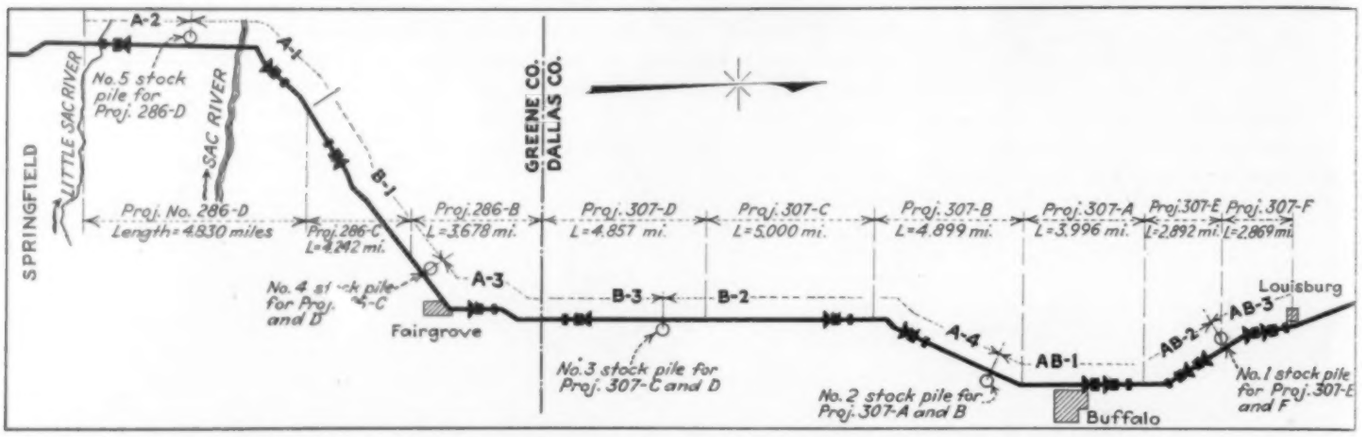
AFTER MOVABLE KNIFE BLADE *(below)* on machine has made transverse slot, workman installs joint strip.

Mixing Cycle—The Missouri State highway department required 75 seconds' total mixing time in the two mixers, the water, of course, being admitted to the first drum. When only one mixer is used, the state specifies a 72-sec. mixing period. This length of time allows 12 sec. for the entrance of water and 60 sec. for mixing with all materials in the drum.

The Hoeffken Brothers' Construction Co. divided the 75 seconds, 35 in the first mixer and 40 in the second. Two factors were responsible for this distribution of time. Charging of the first mixer with a dry batch took 7 or 8 sec. The wet batch slid into the drum of the second paver in a small fraction of a second; by the time the skip reached top position, the wet batch had been discharged. The second reason for a short period in the first paver was to force faster movement of trucks on and off the skip. A truck driver had about 15 sec. in which to back on to the skip and dump his load. This period was ample for the one-batch trucks used.

Additional Equipment—On hauls of 2 miles from the material-handling set-ups, one-paver outfits required 20, 21, and 23 trucks. Over the same distance, the tandem-paver arrangement demanded 33 trucks to keep the mixers operating at capacity. In addition to the 60 per cent greater number of trucks and to the extra crane, the higher rate of progress of the tandem-paver outfit made 7,000 lin.ft. of forms necessary, an increase of 50 per cent.

With each of its single-mixer outfits, the Hoeffken Brothers' Construction Co. had a crew of 60 men,



LOCATION PLAN and order of paving operations. After completing 26½ miles individually, pavers A and B combine to build 12 miles in tandem.

including the night gang. The tandem arrangement required twelve additional men: one mixer operator, one crane operator, three cement handlers, two workmen on lining forms, two on final subgrade cleaning, one puddler, and two finishers.

Finishing—Even at a progress rate of 150 ft. an hour, the Lakewood finishing machine was able to make the necessary three trips over the fresh concrete, tamping the first time and screeding three times. Use of the Lakewood dual-rail form resulted in an exceptionally smooth surface.

A self-propelled Flex-Plane machine, following the finisher, installed center and transverse contraction joints, the latter being spaced 40 ft. apart on fills or in shallow cuts and 20 ft. apart in deep cuts. The machine cut the slot for the center-line joint as it traveled forward and carried a movable knife blade for making the transverse slots. Premolded joint strips, 5 ft. long and 3 in. deep, were joined with wire clips when being fed into the center-line joint in a continuous ribbon. In the transverse joints, the strips were not clipped together.

The high speed of laying slab made three sprinklers necessary to keep the burlap covering wet the first day. A 2½-in. pipe line supplied water for the two mixers and the sprinkling.

Equipment List—The following equipment provided for efficient operation of the two pavers in tandem.

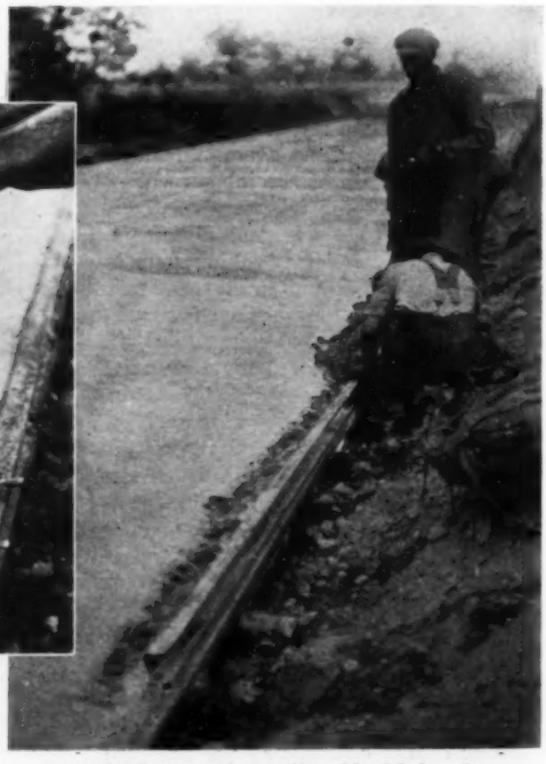
Subgrade:
- 1 Austin-Western 12-ft. blade grader for rough grading.
- 1 Austin-Western 5-tooth scarifier for rough grading.
- 1 Adams 8-ft. blade grader.
- 2 Perry automatic fresnoes.
- 1 Lakewood subgrader.
- 2 60-hp. Caterpillar tractors.
- 1 30-hp. Caterpillar tractor.
- 2 20-hp. Caterpillar tractors.
- 1 Fordson roller with concrete-filled wheels.

Paving:
- 2 Koehring 27-E paving mixers, each with subgrade planer attached.
- 1 Lakewood finishing machine.
- 7,000 lin.ft. Lakewood dual-rail forms.
- 150 lin. ft. dual rail.
- 3,800 lin.ft. rail for lip curb.
- 1 Freeman turntable.

Finishing:
- 1 Lakewood finishing machine.
- 1 Flex-Plane machine.
- 1 rolling bridge for workmen using 10-ft. plow-handle longitudinal float.
- 2 long-handled 10-ft. straight-edges.
- 2 long-handled hand floats.
- 1 bridge for edging joints.
- 1 burlap carrier.
- 1 calcium chloride spreader.

DUAL RAIL distributes load of finishing machine and assures smooth surface for completed concrete slab.

SPECIAL FLOAT shaped to contour of lip curb finishes this important part of pavement.



LIP CURB is cast integrally with slab by placing 3-in. rail on form and shoveling concrete against it while slab concrete is fresh.

CEMENT TRUCK hauling 120 sacks transfers load directly to batch trucks or to temporary platform.

TWO ¾-YD. CRANES *(right)* handle sand and gravel into 72-ton bins to keep tandem pavers supplied.

Batch trucks on job:

10 Ford Model A's.
48 Ford Model T's.

Material handling:

2 Koehring cranes with ¾-yd. clamshell buckets.
1 Blaw-Knox 72-ton bin.
10 Hug 3½-ton trucks to haul cement.

Schedule of Operations—The accompanying sketch shows the sequence of job operations. Pavers A and B started back to back between stock piles 4 and 5 on April 17 and 18. They proceeded individually as indicated until Aug. 13, when the two mixers inaugurated the tandem hook-up.

Night Work—A night crew to move forms and complete subgrade preparation greatly expedited operation of both single- and dual-paver outfits. The night gang began pulling forms about midnight. A mobile light plant facilitated the work of this shift. Two folding portable steel towers, 15 ft. high, carried Crouse-Hinds 1,000-watt floodlights, and a Ford truck, on which the Kohler 2,000-watt light plant was mounted, also carried four Crouse-Hinds 250-watt lamps on telescopic posts adjustable to 15 ft. above the truck roof. The Kohler plant was able to take the full 3,000-watt load on the few occasions when all six lamps were in use. The light plant has proved a real economy.

IN CHARGE ON JOB. *(Left to right)* EDWARD P. HOEFFKEN, HUBERT H. HOEFFKEN and ALBERT C. HOEFFKEN, of Hoeffken Brothers' Construction Co.; M. F. Curran, superintendent for M. E. Gillioz; and J. R. Parker, project engineer, Dallas County.

PORTABLE ELECTRIC LIGHT PLANT facilitates work of night crew. Generator of 2,000-watt capacity supplies full complement of two 1,000-watt lamps and four 250-watt lamps when necessary.

Management—In charge of the work under T. H. Cutler, chief engineer, and H. P. Mobberly, division engineer, Missouri State Highway Department, were J. R. Parker, project engineer, Dallas County, and J. T. Baugher, project engineer, Greene County. Three of the five Hoeffken brothers directed operations on the job: Albert C., Edward P., and Hubert H. M. F. Curran was superintendent for M. E. Gillioz.

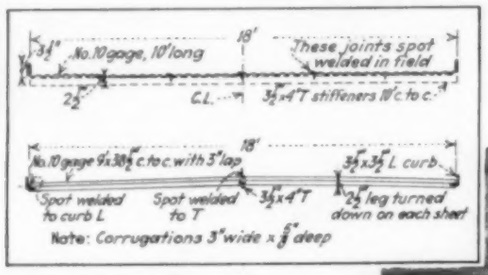
Experimental

METAL-BASE BRICK PAVEMENT

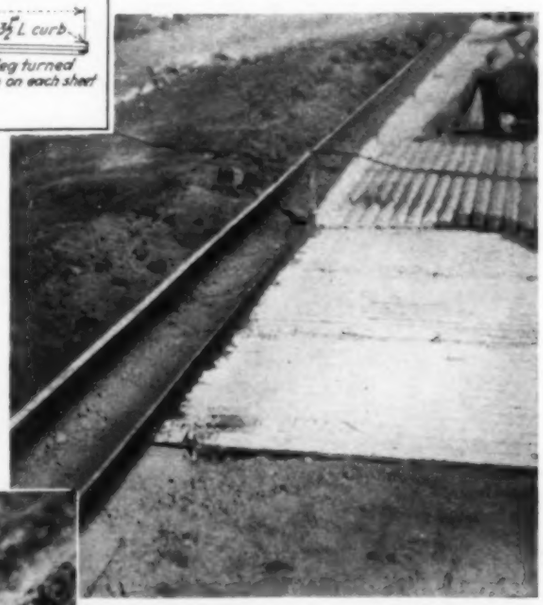
Tests Corrugated and Flat Sheets

FRANK T. SHEETS *(left)*, Illinois state highway engineer, and WILLIAM H. MOSELEY, vice president, Poston-Springfield Brick Co.

THE experimental metal-base brick pavement laid during September, 1930, on the Sangamon County state-aid highway connecting South Grand Avenue, Springfield, Ill., with the Rochester road, is the first practical step in the development of this entirely new method of highway construction. Working on the theory that a pavement having a sheet-metal base and a brick wearing course would be strong enough to bridge inequalities of the subgrade and flexible enough to prevent surface cracks, W. H. Moseley, vice-president of the Poston-Springfield Brick Co., obtained permission from Frank L. Sheets, state highway engineer, and Truman L. Flatt, county superintendent of highways, to construct 150 ft. of experimental road. With the co-operation of the National Paving Brick Manufacturers' Association, G. F. Schlessinger, chief engineer, and of the American Rolling Mill Co., three types of metal base were designed and laid.


3½" No.10 gage, 10' long
18'
These joints spot welded in field
2½"
C.L.
3½"x4" T stiffeners 11' c. to c.
18'
No.10 gage 9"x38½" c. to c. with 3" lap
3½"x3½" L curb
Spot welded to curb L
Spot welded to T
3½"x4" T
2½" leg turned down on each sheet
Note: Corrugations 3" wide x ⅜" deep

CROSS-SECTIONS *(left)* of two designs using corrugated sheets, upper with corrugations longitudinal and lower with corrugations transverse.



CURB ANGLE is used with transverse corrugated sheets. Note notched end of turned-down edge. Road forms are merely for convenience, to give line and grade.

AFTER TAMPING, loose material of scratched subgrade retains shape of corrugated sheet, giving evidence of complete support under sheet. TACK-WELDING *(in oval)* two corrugated sheets to each other.

Construction Conditions—The experimental section was included in the 4/5-mile contract of the Sangamo Construction Co., of Springfield, Ill. This contract, which passes the plant of the Poston-Springfield Brick Co., called for a 2½-in. vitrified brick wearing

FLAT PLATES *(above)* **lap one another. Turned-down edge enters subgrade; turned-up edge forms curb.**

EXPANSION JOINT *(below)* **is designed for installation every 50 ft. in base constructed of these plates.**

course, with asphalt-filled joints, laid over a 1-in. bituminous sand mastic cushion on a 5-in. concrete base. The pavement has a total width of 18 ft., including two 12-in. curbs, making the width of the brick surface 16 ft. On the metal-base section, the same brick wearing course and the same thickness of sand mastic cushion were used; but

HAND TAMPS AND SLEDGE HAMMERS *(above)* **drive turned-down edge into subgrade and bed sheet solidly on loosened earth. AFTER SUBGRADE HAS BEEN SCRATCHED WITH RAKE** *(in oval)* **workmen place flat plate, weighing about 400 lb.**

TRUMAN L. FLATT, superintendent of highways, Sangamon County, Ill.

metal curbs gave the brick surface a full 18-ft. width.

B. F. Nelch, head of the Sangamo Construction Co., co-operated with the promoters of the experiment in constructing the metal-base section. After the concrete base had been completed, a roller was put on the subgrade of the 150-ft. gap to prepare it for the laying of the sheet-iron base. The Illinois black clay loam of the subgrade was really too wet to be rolled at the time; but the subgrade had to be ready for base-laying operations in the next few days. As a result of the wet rolling, the clay loam dried out hard as adobe. It was necessary for the workmen to cut grooves in the surface with hatchets before driving the turn-down edges of the sheets into the subgrade.

Three Designs—As a result of tests conducted by the American Rolling Mill Co. and of a desire to see the practical working out of several theories, Mr. Moseley and his colleagues constructed one 50-ft. section of 10-gage corrugated and galvanized sheets with corrugations longitudinal, one 50-ft. section of the same kind of sheets with corrugations transverse, and one section of flat blue annealed sheets $\frac{1}{4}$ in. thick. All the sheets were of Armco iron.

The corrugated sheets were taken from stock and were cut to fit the road dimensions; but the flat sheets were designed and manufactured expressly for the experimental road. Turned-down edges of both flat and corrugated sheets were driven into the subgrade

to bond the sheets to the subgrade and prevent lateral movement. T-bars driven into the subgrade supported the ends of the corrugated sheets, which were tack-welded to the T-bars and to each other. By scratching the subgrade with a rake to a depth of 1 in., the construction crew was able to bed the sheets solidly, using tamping irons and sledge hammers for this purpose.

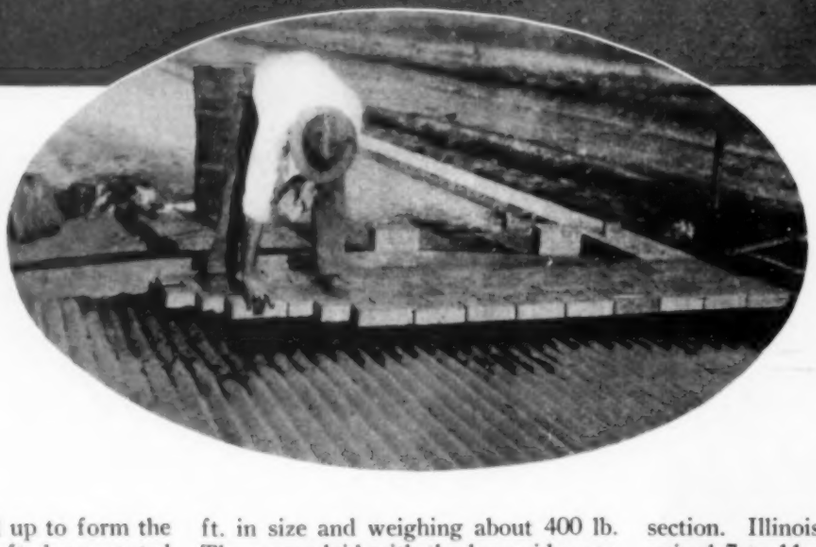
First Section—The first section of base to be constructed had the corrugated sheets laid longitudinally. As the cross-section shows, the sheets lapped one corrugation. A 2½-in. leg was turned down to enter the subgrade and a 3½-in. leg was turned up to form the curb. The sheets, 10 ft. long, rested at each end on a 3½x4-in. T-bar, the ends of the turned-down edges being notched to permit the sheets to lie flat on the bar. To give greater stability and strength to the base, the sheets were tack-welded to the T-bars and to each other. The 30 sheets and six T-bars of this section thus made up a welded unit of base.

Second Section—The sixth T-bar of the first section also formed one end of the iron bed frame on which corrugated sheets of the second section were laid transversely. These sheets were cut to 9-ft. length, and were placed with one end on a 3½x4-in. T-bar along the center line of the road and with the other end on a 3½x3½-in. curb angle. Curb angles were necessary because of the difficulty of bending sheets against the corrugations. The iron bed frame consisted of the center-line T-bar and the two curb angles, welded at each end of the 50-ft. section to a transverse T-bar. Tack welds were made at each corner of every sheet and at two intermediate points on each side.

Third Section—The specially designed blue annealed flat iron plates were rather large and heavy, being 9x5 ft. in size and weighing about 400 lb. They were laid with the long side normal to the center line and were lapped and tack-welded. The photographs illustrate the construction quite clearly. A 3½-in. leg on the outside edge of each plate formed the curb; 2½-in. legs on one or two other edges of each plate were turned down to grip the subgrade. Inside corners of certain plates were notched to eliminate one lap of metal where four plates came together. As it was, each junction of four sheets produced a ¾-in. thickness of iron. Tack welds were made at each corner and at two intermediate points along each side in contact with another metal plate.

To provide for movement in the metal base caused by temperature changes, a 2-in. expansion joint was installed at each end of the 150-ft. section. Although Armco iron sheets have known qualities of rust-resistance, the under side of the sheets was painted with Nitrose or covered with a three-layer No-ox-id combination as an additional protection.

Brick Surface—Mastic sand cushion and brick course were placed in the regular course of completing the Sangamo Construction Co.'s 4/5-mile section. Illinois 1930 specifications required 7 to 11 per cent tar bitumen in the sand cushion. The contractor adjusted the proportions to keep the mixture from getting too fat. Workmen struck off the cushion with a templet and compacted it with a hand roller. After the brick had been laid, a 5-ton steam roller bedded them in the cushion. Inspectors followed the usual practice in culling defective brick and checking the smoothness of the pavement surface. Joints between the bricks were closed with asphalt filler spread by a hand-operated squeegee pot on wheels.



AFTER SAND MASTIC CUSHION *(above)* has been spread and rolled, brick-laying crew places wearing surface of 2½-in. vitrified paving brick.

SAMPLE OF PAVEMENT CONSTRUCTION *(left)*. Vitrified brick 2½-in. thick are laid on 1-in. bituminous sand mastic cushion covering 10-gage corrugated and galvanized iron sheet.

BLACK-TOP
Surface Treatment Produces
NON-SKID BRIDGE ROADWAY

TAR AND CRUSHED SLAG surfacing *(above)* was applied to the old wood block roadway on the main bridge deck.

ASPHALTIC CONCRETE was spread to a thickness of 2 in. over the old granite block paving on the 4-per cent grades of the bridge approaches.

SURFACE treatments with asphaltic concrete mix on granite block and with tar and stone chips on wood block have converted the former slippery roadway of the Detroit-Superior high level bridge and its approaches at Cleveland into a non-skid thoroughfare. Since this crossing over the Cuyahoga River and valley is one of the heavy traffic arteries of the Cleveland district, it was necessary to carry on paving repairs intermittently, so as to cause minimum interference to the steady flow of vehicles across the structure. The Traffic Division of the city's Police Department directed the resurfacing operations.

Original Pavement—The east and west approaches to the steel arch suspended deck are paved with granite block jointed with cement mortar. The total length of the approaches is 2,300 ft., each approach rising to the steel arch at a grade of 4 per cent. This surface had become somewhat uneven, due to the shifting of the sand cushion under the block and had also become polished and slippery, due to the heavy traffic.

The deck over the river is suspended from the main steel arch and is paved with wood block set in tar. This section of the bridge has always been the scene of skidding in wet weather. The wood block pavement measures 590 ft. long and 45 ft. wide.

Surface Treatment of Pavement—The Cuyahoga County Road Repair Department, under the supervision of J. M. McCleary, deputy engineer, undertook to eliminate economically the inconvenience of the old pavement without the resulting traffic tie-up if the old pavement were entirely removed and the new relaid. To accomplish this result it was decided to use a single layer of asphaltic concrete mix, spread over the old surface and rolled to a minimum thickness of 2 in. General specifications for the mix provided for broken limestone not more than 1 in. in size. The mix was delivered to the job at a temperature of 150 deg. F. to bring out the liquefier oils and bind to the granite block. The surfacing was applied in sections, and each section was opened to traffic almost immediately upon being completed. The resulting surface is one upon which tar and stone chips can be sprinkled, making a surface safe for high speed congested traffic.

The wood block deck pavement was given two successive applications of hot tar flushed over the surface. Crushed slag was sprinkled after each flushing of tar and then rolled.

Baldwin Brothers Construction Co. performed the work on the approaches and Garland Brothers Construction Co. resurfaced the deck of the bridge.

WIDENING
Long Island's Concrete Roads

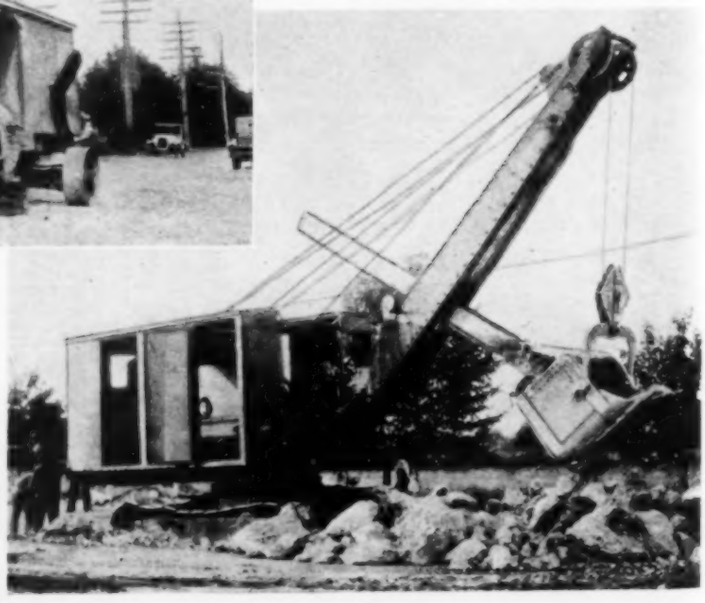
TO ACCOMMODATE the huge volume of motor traffic that converges upon the main highways of Long Island, particularly in summer when the beaches, hotel resorts and suburban communities attract New Yorkers by the thousands, the Division of Highways of the New York State Department of Public Works is engaged upon a program of road widening and reconstruction on a number of the most heavily traveled routes. The main highways run in a general east-west direction, paralleling the shores of the long, narrow island which extends about 115 miles from Brooklyn to Montauk Point, and varies in width from about 15 to 20 miles.

Typical of last year's operations was the widening of the existing 30-ft. Amityville-Babylon concrete road, along the south shore, by the addition of a new 10-ft. lane; the reconstruction of the Hempstead-Farmingdale road, involving the breaking up and removal of old pavement and its replacement with a new 30-ft. width of concrete; and the relocation and widening of sections of the Jericho turnpike to provide a route of four 10-ft. traffic lanes instead of two. For all of these improvements concrete pavement was employed.

The state specifications call for a flat slab 9 in. thick, reinforced. Accurate batching by weight is required and contractors are permitted to cure

THREE - LANE RECONSTRUCTION showing left-hand strip of old pavement maintained to carry traffic, middle strip being broken up and graded by power shovel and right-hand strip newly paved with 10-ft. concrete slab.

SKULL CRACKER in form of heavy weight dropped from boom of skimmer scoop or crawler crane breaks up old pavement as first step in reconstruction.



BROKEN FRAGMENTS *(above)* of old reinforced concrete slab are removed by power shovel.

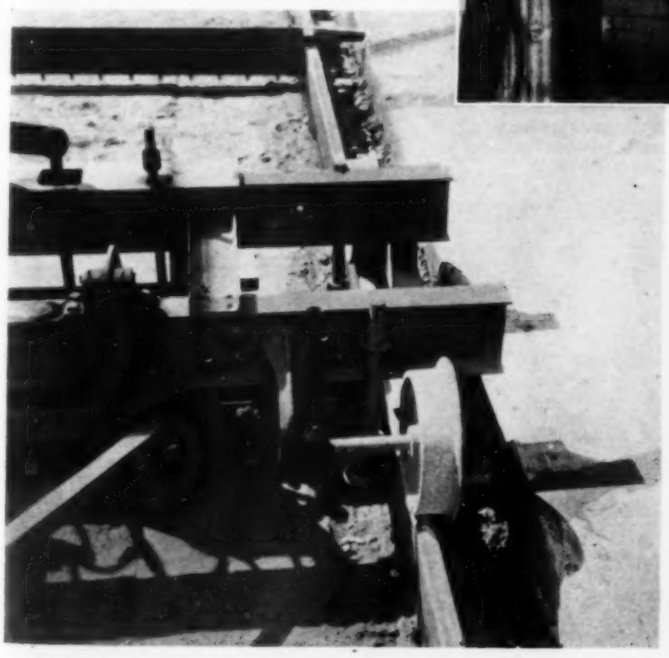
BULLDOZER on tractor *(left)* helps push aside old broken pavement, prior to grading for new slab.

DURING WIDENING existing paved surface proves useful in carrying mixer and material trucks for building additional 10-ft. strip.

CLEARING AND GRADING for new 10-ft. strip involved removal of trees and shrubbery and excavation with skimmer scoop.

finished pavement either with sprayed asphaltic emulsions or by sprinkling with water. Transverse expansion joints are introduced at intervals of 78 ft. 6 in. Additions to existing roads are made in 10-ft. widths and an important feature of this work, as typified by the Amityville-Babylon road widening, is the provision of a bituminous paved strip 1 ft. wide between the existing pavement and the new 10-ft. concrete slab, the purpose of which is to compensate for irregularities between the old and new grades.

A. D. GREENMAN *(left)* supervising engineer, State Division of Highways; HARRIS GRAND, assistant engineer, and D. G. DAVIS of the Municipal Construction Co.



GAP of 1 ft. is left between existing pavement and new 10-ft. slab to equalize irregularities between old and new surface grades.

AFTER FILLING the 1-ft. gap with second-class concrete, it is surfaced with a 2-in. bituminous wearing course.

TYPICAL GRADING OPERATIONS involving use of scarifiers, rollers, blade machines and subgraders on Amityville-Babylon widening contract.

Another condition which has an important bearing on all of the widening and reconstruction work is the necessity of carrying traffic through the job while new paving is in progress.

Daniel Kraft, contractor, of Oyster Bay, Long Island, had the 5 mile long contract for extending the existing 30 ft. wide concrete highway between Amityville and Babylon by the addition of a new 10-ft. lane. Trees and shrubbery along the roadside for the additional width had first to be cleared before the subgrade could be excavated by a skimmer scoop, leveled and rolled. Concreting was done with standard equipment with the advantage that both the paving mixer and the material trucks were able to operate on the paved surface of the existing highway.

Forms for the new 10-ft. strip were set to leave a gap 1 ft. wide between the old pavement and the new. After the new slab had been finished this gap was filled with second-class concrete from hand buggies and surfaced with a 2-in. cold-mix Tarvialithic wearing course. This narrow, bituminous-paved strip performs the function of adjusting any differences in grade between the old and the new paved surfaces and acts, also, as a traffic line.

NEW 10-FT. LANE, at right, is separated from existing pavement by 1-ft. bituminous surfaced strip.

On the Westchester Construction Co.'s contract for reconstructing 2.77 miles of the Hempstead-Farmingdale route it was necessary to break out and remove old bituminous macadam and concrete and repave in 10-ft. lanes to a 30-ft. width while maintaining traffic through the job. The contractor chose the Curecrete sprayed asphaltic emulsion method instead of water for curing; the application was made at the rate of 1/12 gal. per square yard.

A heavy job of pavement breaking faced the Thomas Connor Contracting Co. before relocation and repaving to a 40-ft. width could be undertaken on a section of the much traveled Jericho turnpike. The old concrete surfacing, reinforced, was first fractured by a skull-cracker and then loosened and dug out by power shovel. A bulldozer on a Caterpillar removed the débris.

The work is under the general direction of Col. Frederick Stuart Greene, superintendent of public works, and Arthur W. Brandt, commissioner of highways, with J. J. Darcy, district engineer, and A. D. Greenman, supervising engineer.

CURING is done on Hempstead-Farmingdale route by spraying asphaltic emulsion on newly finished concrete slab.

WIRE BROOM is drawn across wet concrete to produce roughened, non-skid surface and to eliminate concrete laitance.

BUCKET ELEVATOR on front of machine delivers road metal from stack to weighing hopper and oil-mixing compartment.

ROADSIDE PLANT
Mixes Oiled Surfacing

A SELF-PROPELLING machine which picks up road metal piled in stacks, weighs and mixes it with a predetermined quantity of hot oil, is a new development used by the Hargrave Construction Co. of Cedar Rapids, Iowa (operating on the Pacific Coast under the name of the Hargrave & Doolittle Co.), on a road oiling job for the Montana State Highway Department between Butte and Dillon. The chief advantages claimed for this machine are the accurate proportioning of the oil and the elimination of a number of the blading operations usual on this type of construction.

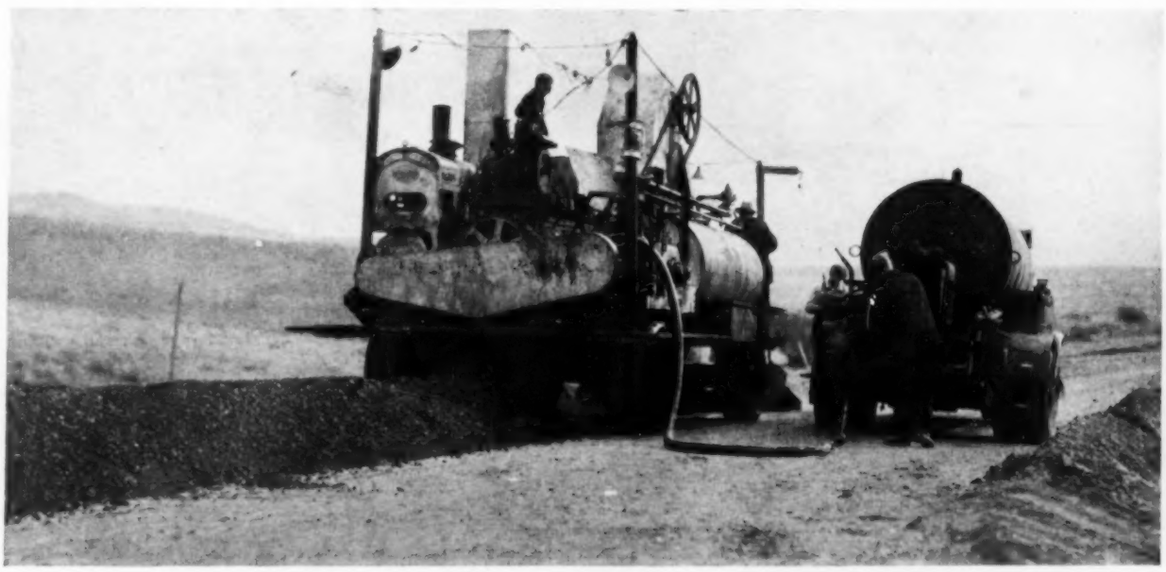
The features of the machine are a bucket elevator at the front end discharging into a weighing hopper, a measuring device for hot oil, and a 15-ft. mixing compartment equipped with paddles. The mixed material drops from the end of the mixer on to the road surface in a stack ready to be spread.

The mechanism is driven by a 65-hp. gasoline engine. The equipment is designed to mix from 50 to 60 cu.yd. of dry material per hour and to travel 2 to 7 ft. per minute. Two 400-gal. heated tanks on the machine contain the oil supply. This oil supply is replenished, as required, by an ordinary distributor truck which can refill the tanks on the machine without stopping the operation.

On the Butte-Dillon job, the first place the machine was ever tried, the work required a 3-in. thickness of oiled surfacing on an 18-ft. width of roadway. Equipped with an electric lighting plant, the machine was able to mix one mile of this surfacing in a 20-hour run. The proportion of oil used amounted to about 1½ gal. per square yard of surfacing or 4.6 per cent of oil content in the finished product. The weighing hopper was set to measure a 109-lb. batch of material and to this was added 0.65 gal. of oil.

Prior to this mixing operation the road metal was bladed into a stack on a quarter point of the roadbed. The resulting position of the machine permitted the passage of traffic and sufficient room for the refueling truck. Following the mixing process, the clear half of the road was given a light tack coat of oil and the mixed material was bladed over on to this oiled surface. Then the remaining half of the roadway was tack-coated and the material was bladed into its final position.

The advantage over the road-mix type of construction is claimed to be the elimination of about twelve bladings necessary to accomplish the same results and the more exact control over the proportioning. In addition, it is comparatively simple to operate the machine at night, the crew is small, and the blading equipment can be reduced. F. M. Hargrave, of the Hargrave Construction Co., developed the machine with the aid of the Iowa Manufacturing Co., Cedar Rapids, Iowa. L. S. Barber was superintendent in Montana.



OIL-MIXED SURFACING is dropped on roadside from rear end of machine. Tank truck at right replenishes oil supply without halting operation of machine.

Greenville County Improves Secondary Roads at Low Cost by

DOUBLE SURFACE-TREATMENT

BASE COAT OF STONE some months after having been opened to traffic and before seal coat has been added.

APPLYING COLD ASPHALT FOR SEAL COAT *(below)* with pressure distributor at the rate of 0.25 to 0.3 gallons per square yard.

MORE than 1,000 miles of secondary roads in Greenville County, S. C., great textile center, have been double surface-treated under contract by the Carolina Road Surfacing Co. during the last two seasons. Preliminary work, undertaken the season before the surface treatment program began, included widening of narrow roads, placing of selected top soil in the base, and reshaping and compacting under traffic during the winter.

When the surface treatment was to be applied the following season, the soil base was first swept to its full width with revolving and hand brooms. All ruts and depressions worn by traffic were filled and compacted. Then a priming coat of 8 to 13 specific viscosity refined tar was sprayed by a pressure distributor from a tank truck at the rate of 0.3 gal. per square yard.

When the priming coat had reached its maximum penetration, normally in about 24 hours, 0.4 gal. of 150- to 200-penetration asphalt per square yard was next applied hot by the pressure distributor and covered with 40 lb. to the square yard of ¼- to 1¼-in. graded and washed blast-furnace slag which was thoroughly imbedded in the asphalt

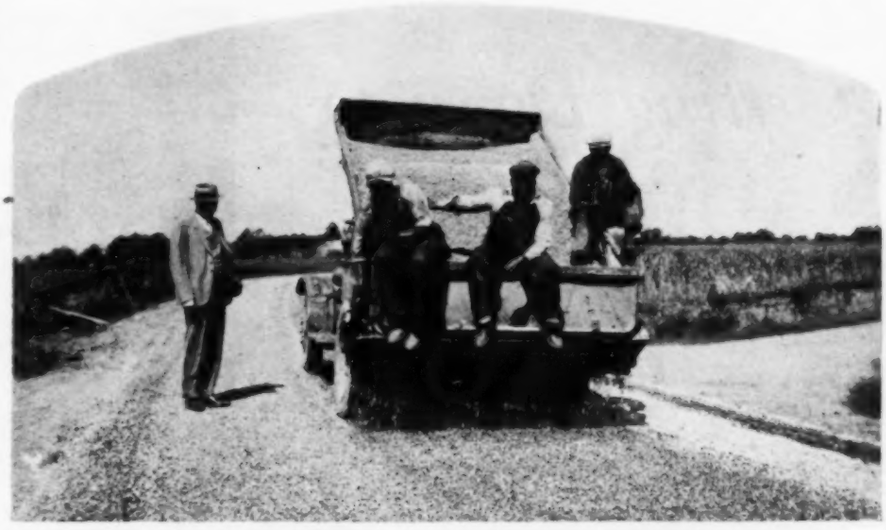
ASPHALT PUMP, mounted on light-car chassis, for filling refueling trucks from railroad tank cars.

UNIFORM DISTRIBUTION OF STONE on seal coat prior to rolling to obtain final bonding and set.

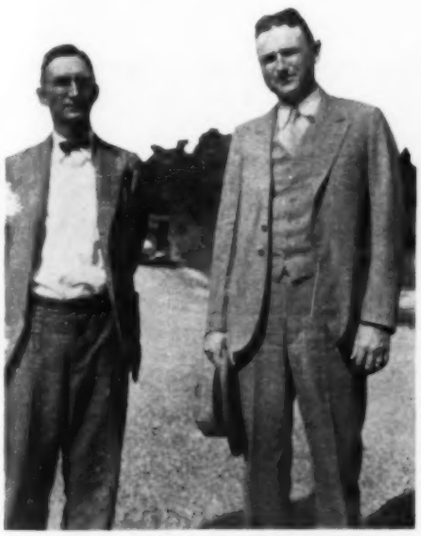
by a 5-ton roller. Then the road was opened to traffic for from 2 to 6 months, depending on conditions. In practically all cases the base coat was sealed before winter.

When the first treatment was properly bonded by traffic, the surface was thoroughly swept before the seal coat was applied. This consisted of 0.25 to 0.3 gal. of 85- to 100-penetration cutback asphalt per square yard. This coating was at once covered with 16 lb. of slag per square yard, ranging from 10 mesh to $\frac{5}{8}$ in. in size. As fast as it was placed, the slag was dragged with a three-section flat steel broom drawn by the roller. The dragging was continued until the stone was evenly distributed and coated. The coating was then compacted with the 5-ton roller. Following this rolling, enough time was allowed to elapse to permit the volatile matter to escape before traffic was admitted to the road, which was usually within 24 hours.

The contractor used for all three bituminous applications Kinney and Etnyre pressure distributors which covered the full width of the 18-ft. surface at one pass. Two 600-gal. tank trucks delivered asphalt from railway sidings to the distributor trucks, allowing the latter to operate steadily on the surface treatment work. To fill the "refueling" tank trucks, a pump was rigged on a light-car chassis. The main drive shaft of the car was cut off and arranged to drive the pump through a universal coupling directly back of the transmission. This portable pumping outfit was towed from one railroad siding to the next by one of the 600-gal. tank trucks.



DISTRIBUTING STONE on seal coat with motor truck equipped with removable distributing device.



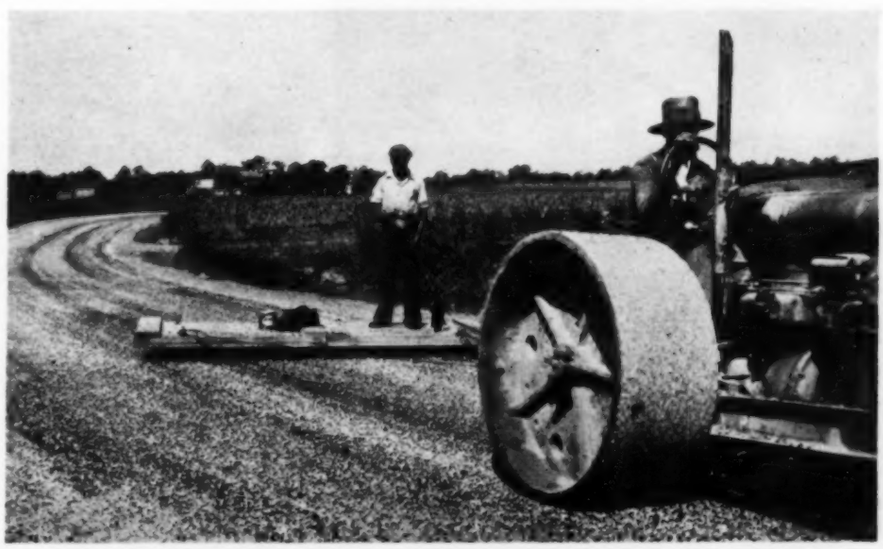
E. D. SLOAN, JR., vice-president of the Carolina Road Surfacing Co., and R. E. DALTON, of Dalton & Nevins, engineers in charge of the project.

The scheme of hauling and handling the bituminous materials greatly increased the area covered by the distributors, when they had to be driven back to the railway for refilling. Prior to its adoption, the average was about a mile of surface covered with seal coat per day. With the two refueling tanks in service, an average of nearly 3 miles a day was maintained.

Crushed slag was distributed by a crew of three men using a Stolle distributor on the tail end of a dump truck. With rare exceptions the contractor loaded the slag directly from the cars to the trucks with a portable belt conveyor. This plan involved some demurrage but elimination of loss of material in stock piles offset this expense. Moreover, the plan of direct handling kept the washed slag clean, an essential on light surface-treatment work.

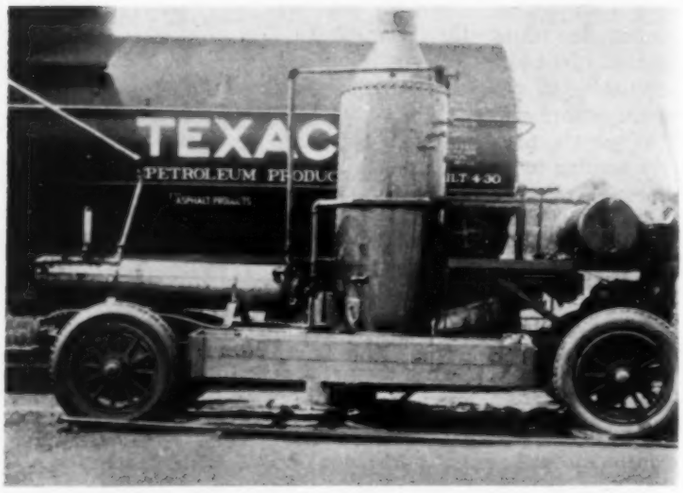
The main job of the men on the stone distributing truck was to make sure that the material did not arch nor clog. When they saw that the feed might become irregular they merely had to revolve a toothed agitator extending the width of the hopper. Working in this manner, the small crew could distribute with great accuracy from 100 to 125 3-yd. trucks of slag in a 10-hour day.

The Greenville Highway Commission employed Dalton & Nevins, of Greenville, as engineers in charge of the entire project. E. D. Sloan, Jr., vice-president of the Carolina Road Surfacing Co., was in charge of the work for that company, with L. D. Huff as superintendent.

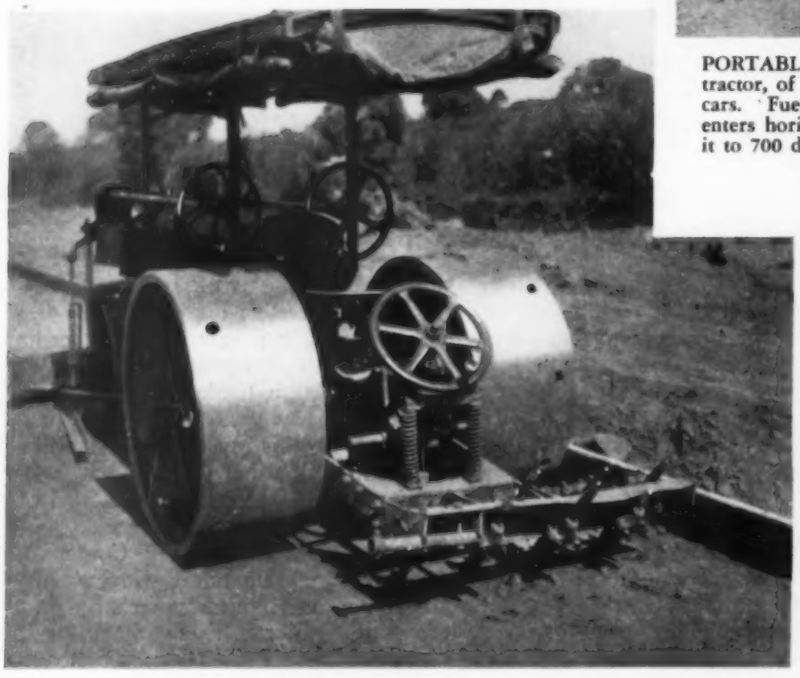


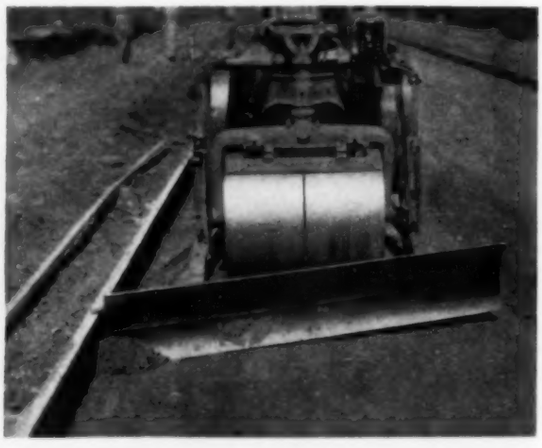
FLAT STEEL BROOM DRAG follows truck distributor to obtain final and completely uniform distribution of stone of seal coat, and to coat stone with asphalt.

Getting Down to DETAILS *of Highway Maintenance and Construction*



PORTABLE SUPERHEATER, devised by Lansdell Co., road contractor, of Hackensack, N. J., aids in unloading asphalt from tank cars. Fuel-oil burner under boiler generates steam which first enters horizontal coil on rear of truck where second burner heats it to 700 deg. F. Superheated steam then passes into coils of tank car to warm the asphalt.



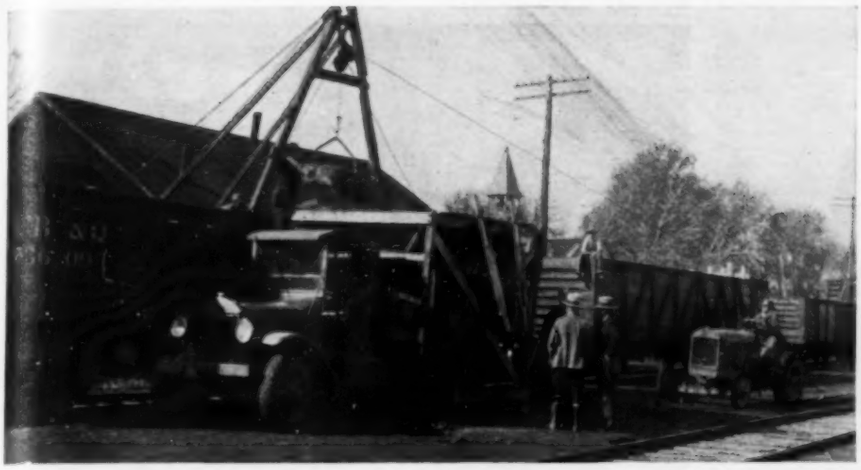


TO CUT SLOPE FOR THICKENED EDGE of concrete slab along steel road form, McCoun Construction Co., of Noblesville, Ind., uses Austin 3-ton gasoline roller equipped with scarifier and adjustable 6-ft. blade. Scarifier teeth loosen any high spots; blade is adjusted to shape slope having taper of 2 in. in 30 in. from form.

BRUSHING ¼-in. stone covering into the voids of a retread or penetration macadam pavement in Iowa, before final treatment.

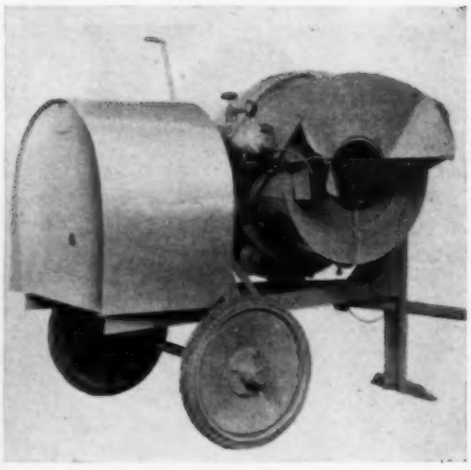
Photos from
W. H. ROOT,
Maintenance Engineer,
Iowa Highway Commission

HIGH SPOTS in a rock asphalt road surface in Iowa are softened by a spray of gasoline, scraped down with shovels and checked with a straight edge.



UNLOADING GRAVEL from railway cars for Missouri roads is done with slip scraper operated by cable through pulley on A-frame. Cable is powered by tractor or hoist.

Photo from
T. H. CUTLER,
State Highway Engineer of Missouri

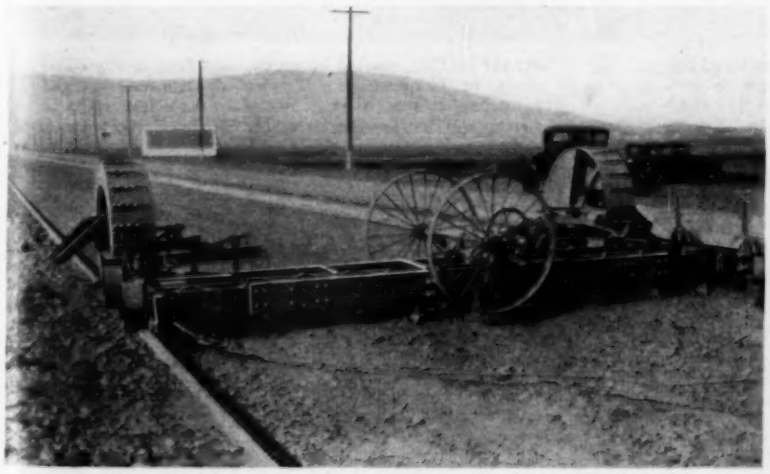


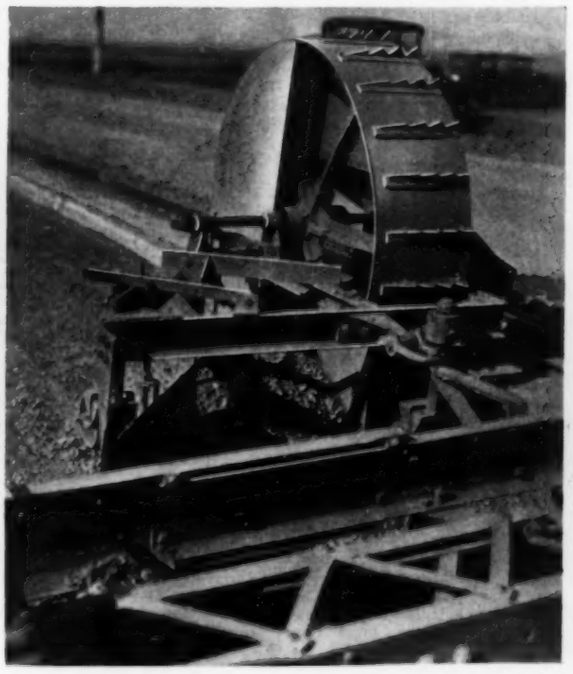
METAL JACKET around mixer drum and oil torch facilitate heating of bituminous patching material in cold weather.

Photo from
C. M. BABCOCK,
Commissioner of Highways, Minnesota

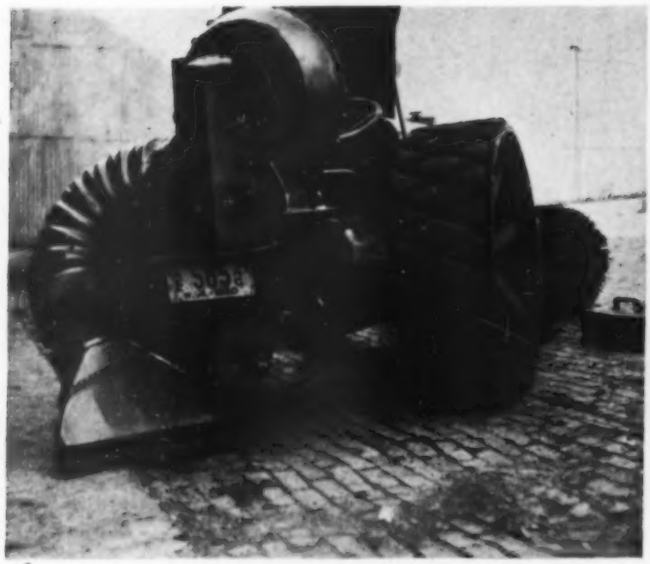
HUB HIGH GUARD RAIL in South Carolina deflects cars back on to roadway. Specifications provide for treated timber. Posts, 6x6 in., extending 2 ft. 2 in. above ground, and 3 ft. 10 in. into ground, are spaced 8 ft. on centers. Guard rail boards, 2x10 in. for top and 3x10 in. for side, are spiked to posts. Three coats of white paint are applied to front faces of planks and all edges except bottom of 3x10-in. plank.

Photos from
CHAS. H. MOOREFIELD,
State Highway Engr., S. C.

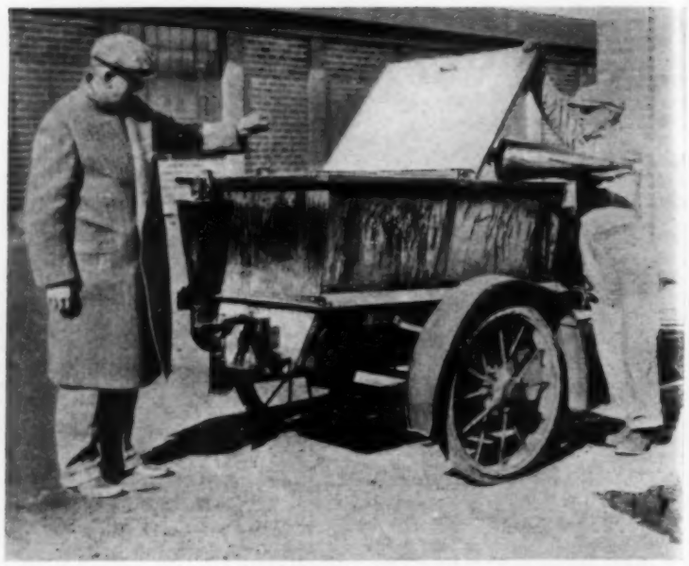




SUBGRADE FOR THICKENED EDGE SLAB on 40-ft. Bay Shore concrete highway in California is shaped for 11-9-11-in. section by setting cutters on Lakewood subgrader to cut to depressed grade at side. Clausen tailing elevator wheels *(right)* removed excess material and deposited it beyond forms. Contractors were Basich Bros. Construction Co., of Los Angeles. The pavement comprises two 20-ft. slabs placed side by side, each 20-ft. slab being divided at the center with a longitudinal weakened plane joint.



COMBINED BLOWER AND SWEEPER cleans pavement before surface treatment and blows dust from stone for mixed-in-place macadam. Tractor carries rotary broom on front and chain-driven blower on rear, feeding adjustable spout through flexible joint of waterproofed duck. — *Photo from* E. G. MIDDLETON, *engineer of maintenance, West Virginia.*



HEATER KINKS for crack-filling work in Iowa. (1) Elbows bolted to fire box of tar kettle receive conical pouring pot nozzles and keep contents hot when not in use. (2) THROUGH BRASS TUBE, closed at lower end, and extending to kettle bottom, thermometer is lowered to get temperature of tar without immersion in it and consequent cleaning.

SPRING LIFT TRACK is depressed by weight of bulk cement hand buggy, lowering canvas discharge hood on to aggregate truck below to prevent loss of cement on Booth & Olson contract.—*Photo from* F. H. MANN, *construction engineer, Iowa Highway Commission.*

ROAD HONE, hauled by truck, smoothes newly oiled roads in Connecticut. Device distributes material uniformly cutting high points and filling low spots in surface.—*Photo from* G. E. HAMLIN, *Connecticut.*

BRUSH DRAG is used in Vermont to spread coarse sand cover on bituminous treated gravel surfacing before final rolling.

SNOW WING on truck, equipped with power takeoff hoist, can be raised or lowered from driver's seat in about 2 seconds.—*Photo from* C. M. BABCOCK, *Commissioner of Highways, Minnesota.*

Step-by-Step Field Methods

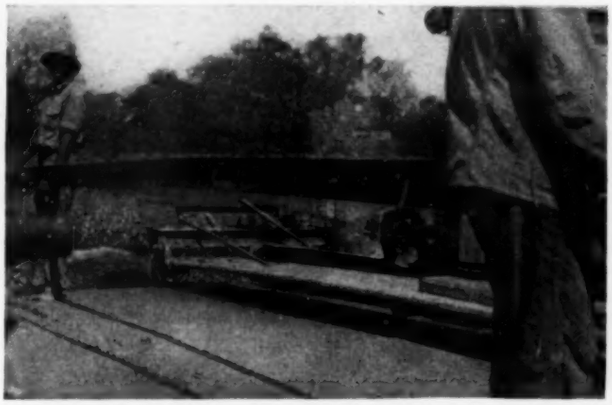
Installing Expansion Joints in Concrete Pavement

Photographs from
JAMES E. PIRIE
Resident Engineer,
Texas Highway Department

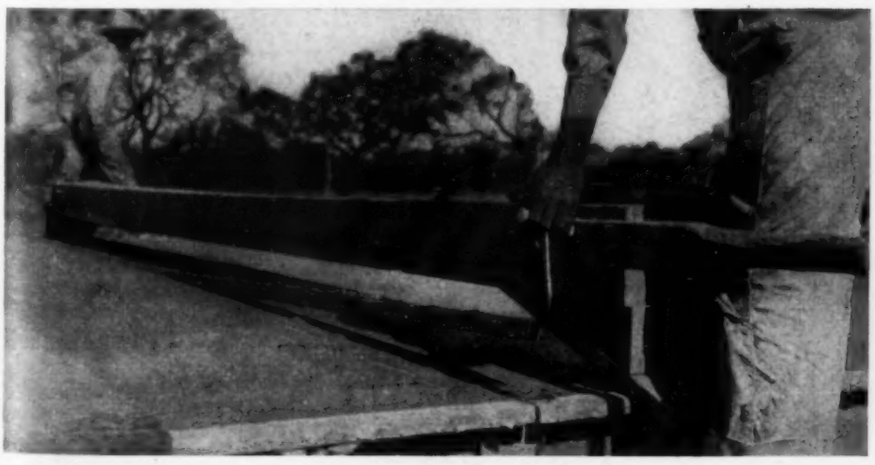
1 STEEL HEADER has angle stiffener extending over U-shaped cap fitted over premolded expansion material. Tin jackets encase dowels.

4 HAND FINISHING of joint is the next operation. View shows premolded expansion material in place and wooden bridge spanning slab.

5 TRIMMING of the premolded joint material is done with picks before the joint space is filled with bituminous material.



2 HEADER IS REMOVED after passage of leading finishing machine equipped with single screed and tamping device.



3 U-SHAPED CAP is lifted after passage of second finishing machine. It remains in place until all machine finishing is completed.

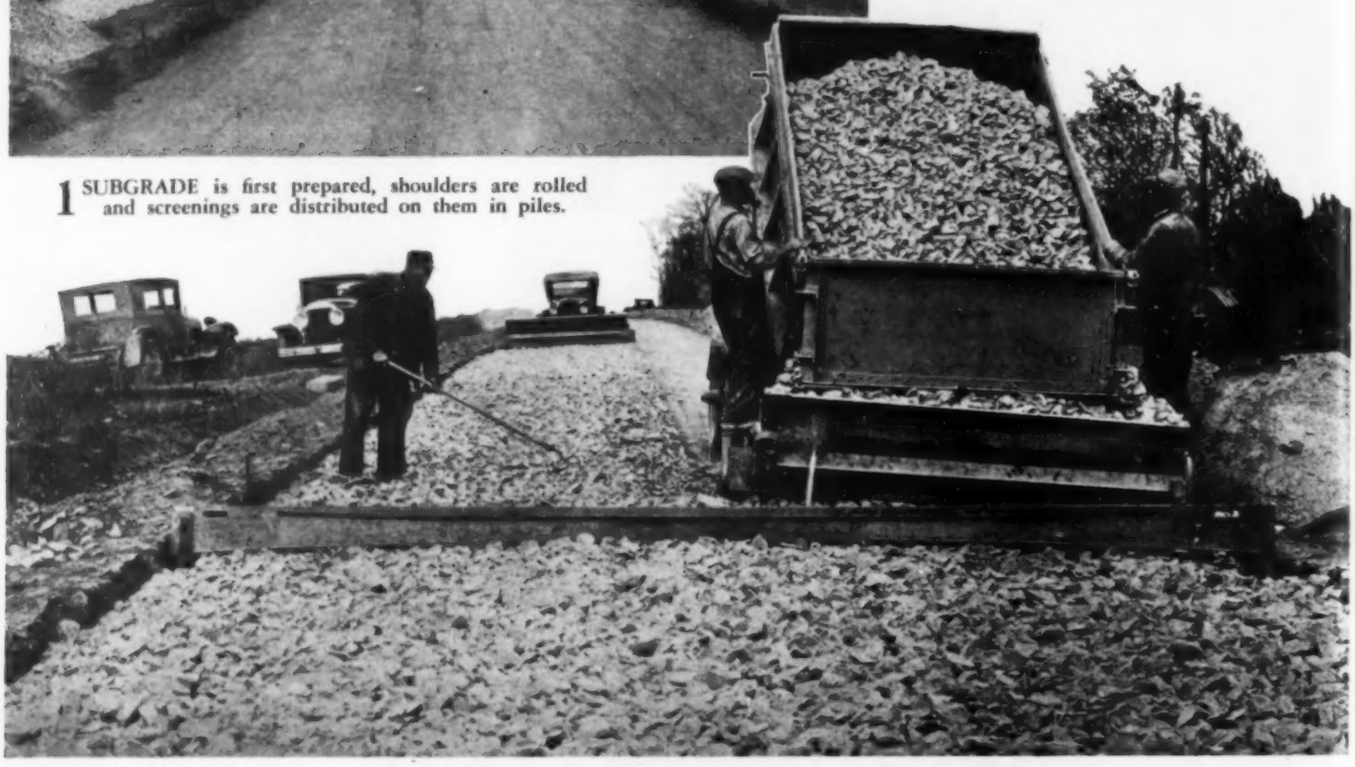
6 JOINT FILLER is poured from hand pot to within ½ in. of the finished surface of the concrete pavement, constituting the final operation.

How State Highway Department

BITUMINOUS SURFACE—

IN THE accompanying series of photographs received from W. A. Van Duzer, assistant chief engineer, are illustrated the various steps followed by the Pennsylvania Department of Highways in constructing 9-7-9-in. bituminous surface-treated macadam road 18 ft. wide, with 5-ft. shoulders.

1 SUBGRADE is first prepared, shoulders are rolled and screenings are distributed on them in piles.



2 FIRST COURSE of 1¼-4-in. stone is distributed by mechanical spreader on rear of truck. Note crown board to control depth of stone and cross-section of pavement.

3 STRAIGHT EDGE, 16 ft. long, applied longitudinally at 1-ft. intervals, indicates low and high spots in stone surface.

4 HAND FORKING METHOD, used to apply the second course of stone, eliminates possibility of segregation of material.

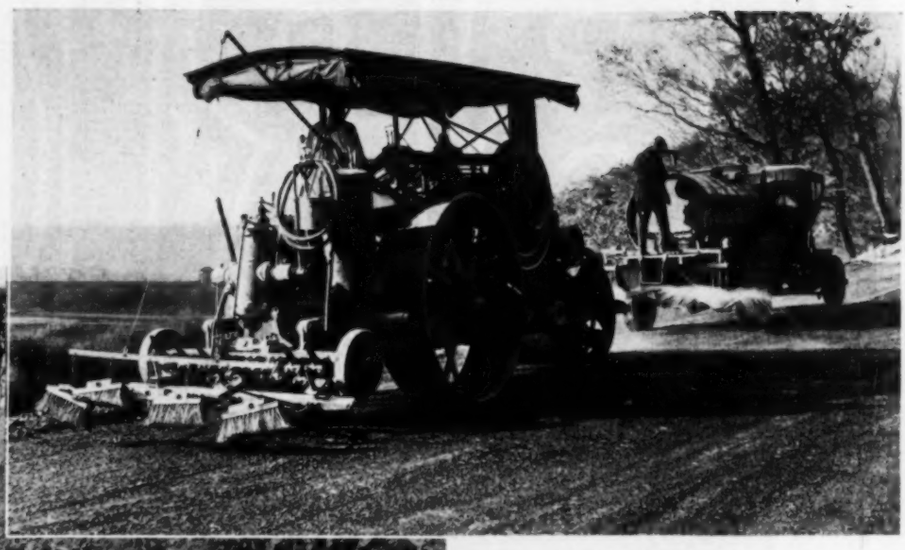
of Pennsylvania Constructs
TREATED MACADAM

After screenings have been piled on the rolled shoulders of the road, a first or foundation course of crushed stone, 1½ to 4 in. in size, is deposited on the subgrade with the aid of a mechanical spreader, locked by rolling and checked for high or low spots with a 16-ft. straight edge. Screenings are then spread on this course and dry rolled. A second course of 1½-4-in. stone is next laid by the hand-forking method to eliminate segregation, and rolled to give a thickness, compacted, of 9 in. at the sides and 7 in. at the center. Screenings are spread, dry rolled, broomed, sprinkled and re-rolled until a grout is formed on the surface.

The man in charge of checking the uniformity of the stone surface with the straight edge also directs the screening gang, using a red flag to mark the point beyond which screenings may not be spread on the locked stone until surface irregularities are corrected. This procedure is said to improve the riding qualities of the finished road 25 per cent.

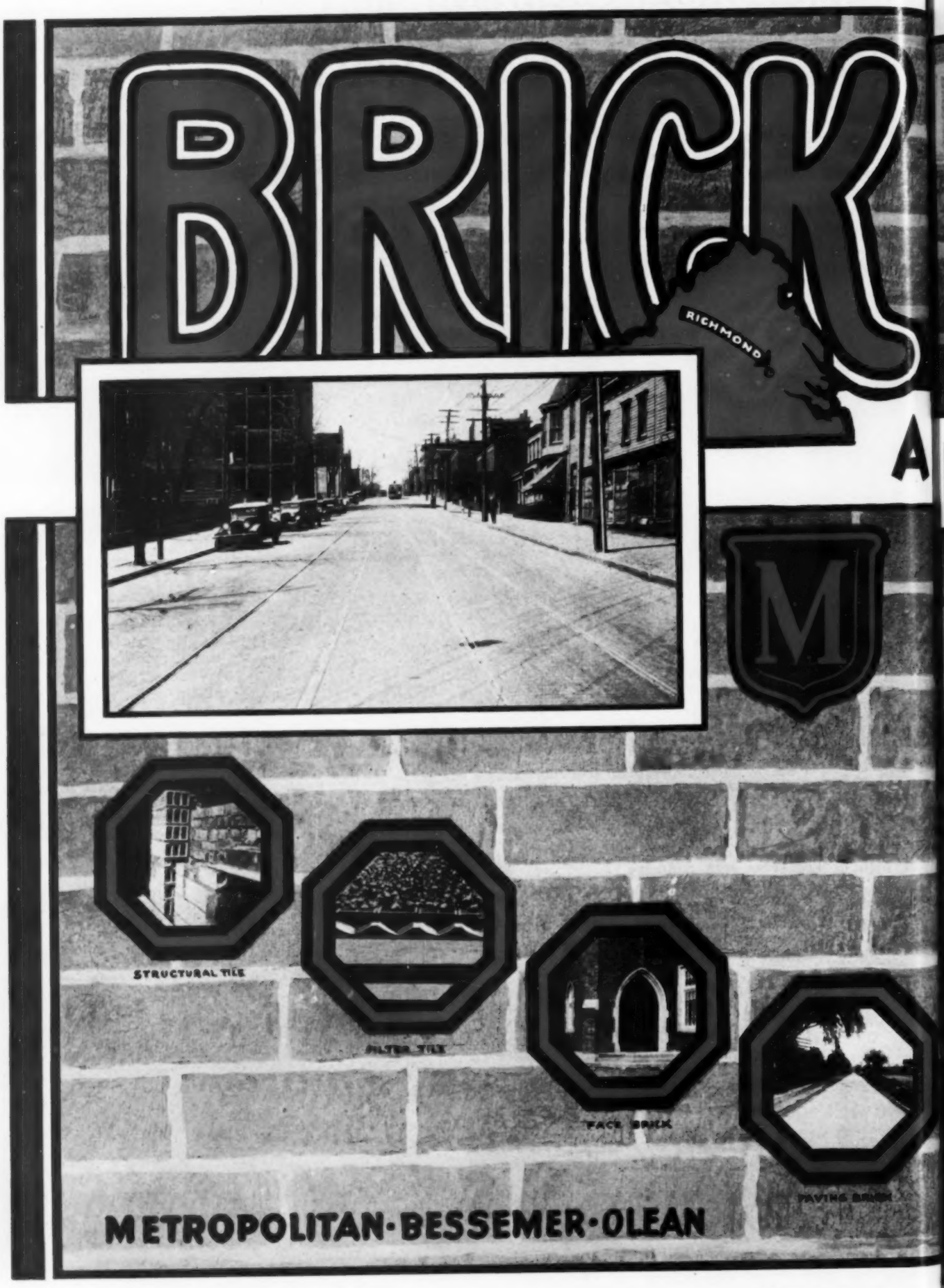
The surface is then subjected to traffic for from one to three months before receiving a bituminous treatment. After being swept with a rotary broom, the surface receives an application of ¼ gal. of cold tar per square yard, without chips. After from one to three months, a second cold application of ¼ gal. of tar is made and covered with 25 lb. of stone chips per square yard. All surface treatments are applied by an 800-gal. pressure distributor.

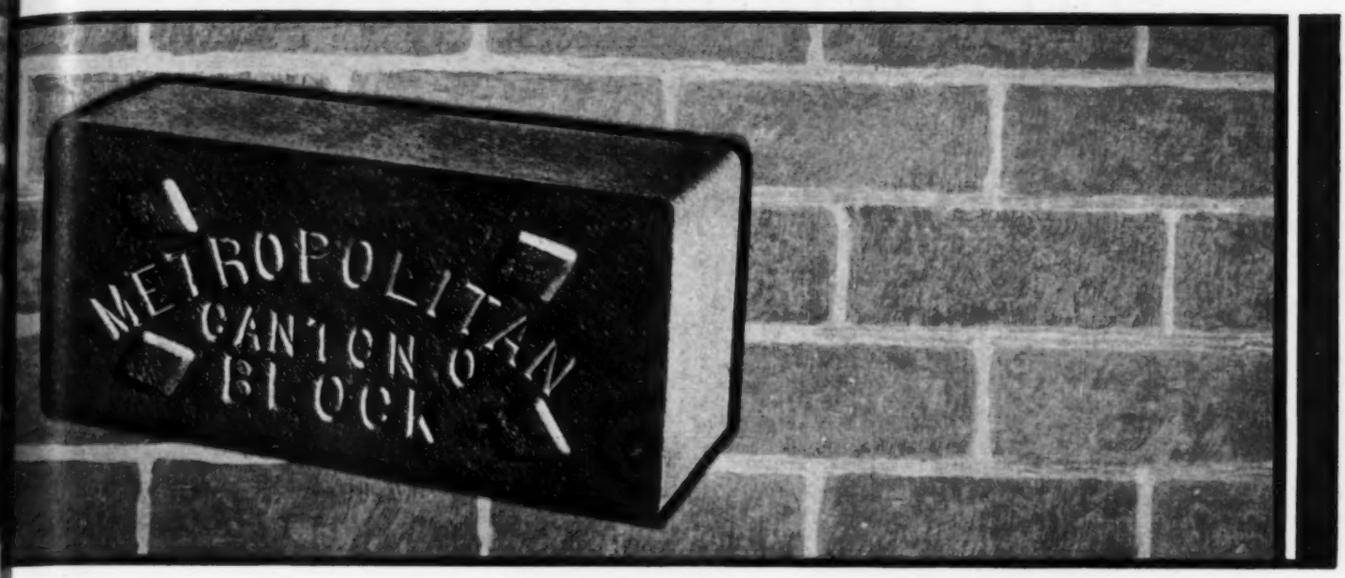
5 SCREENINGS are spread on locked stone by hand shovels only up to point where red flag (on shoulder, at left) indicates that surface has not yet been checked by straight edge.



6 SPRINKLING and rolling are done after application of screenings to top course. This operation works to the surface the grout formed by the wet screenings.

7 PAVEMENT COMPLETED, showing finished surface of roadway and properly shaped and rolled shoulders.


BRICK
RICHMOND
STRUCTURAL TILE
FACE BRICK
METROPOLITAN·BESSEMER·OLEAN



HEAVY TRAFFIC PAVEMENT

In Richmond, Virginia, the engineers selected vitrified brick for these streets which carry the heavy traffic. Marshall Street is shown and on it are street railway tracks and considerable truck traffic.

Vitrified brick has established records in many communities for standing up under heavy traffic for exceptionally long periods of time.

Metropolitan, Bessemer and Olean—three recognized brands, throughout the states east of the Mississippi, have served communities all through the horse drawn vehicle days and are still carrying on under loads they were never intended to stand.

It is this inherent strength of vitrified brick plus the quality obtained in Metropolitan, Bessemer, and Olean block that is making brick more and more popular as the ideal surface where heavy traffic, high speeds and heavy loads are encountered.

THE METROPOLITAN PAVING BRICK CO.
CANTON, OHIO

HALF-WIDTH PAVING *Shows Progress* DESPITE TRAFFIC

A STUDY of four half-width concrete paving jobs completed under traffic during the last season in different New England states reveals the fact that the contractors made good average progress in spite of undoubted delay caused by interference of travel through the projects. Capable management and efficient operation were not enough to overcome all handicaps of maintaining traffic. In each case, the state highway department had sound reasons of public convenience for keeping the road open.

Four Jobs—For the sake of simplicity in preparing tables, the jobs are numbered in alphabetical order.

1. Connecticut. The Osborn-Barnes Co., of Danbury, Conn., paved 6 miles between Newtown and Danbury with 20-ft. slab 8 in. thick.

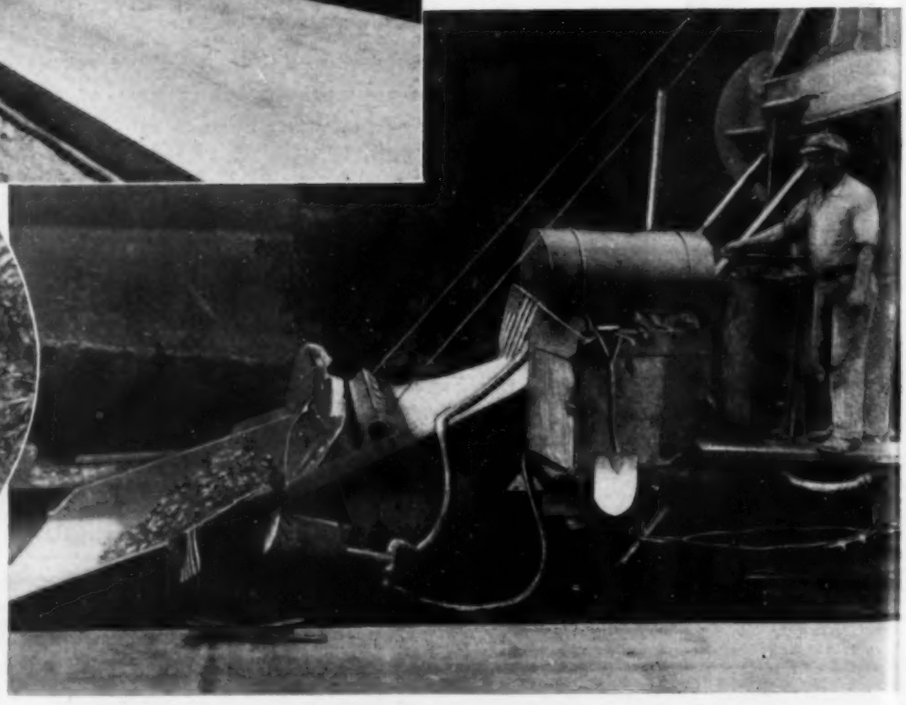
2. Massachusetts. The Sherry Construction Co., of Fall River, Mass., built an 8-in. pavement 20 ft. wide on a 6½-mile section of the road connecting Taunton and East Providence.

3. New Hampshire. The Arborio Road Construction Co., of Hartford, Conn., laid 8 miles of 9-6-9-in. slab 20 ft. wide between Twin Mountain and Bethlehem.

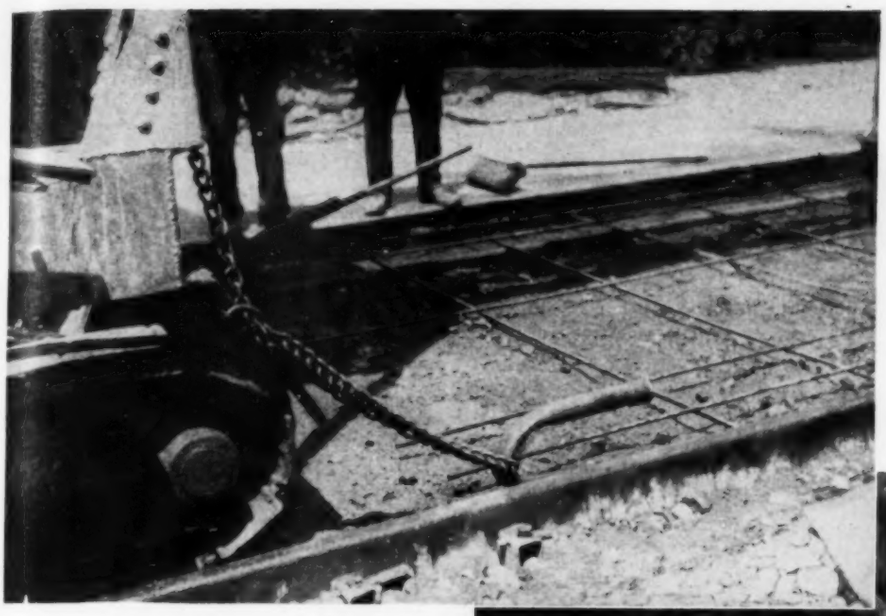
4. Vermont. Miller Brothers' Construction Corporation, of Hartford, Conn., built 7.2 miles of 7-in. concrete pavement 18 ft. wide on the road between Wells River and East Barnet. This concrete pavement was distributed in three approximately equal portions over a total distance of 13 miles. The contractor also built 4.4 miles of bituminous macadam on this project.

Similarity of Conditions—All four contractors paved existing highways, a

HALF-WIDTH PAVING *(above)* and truck hauling are characteristic of all four jobs. Sherry Construction Co. uses pole to carry water hose across completed slab. METAL EXPANSION JOINT *(in circle)* is in two parts, each 5 ft. long, with slotted connection.

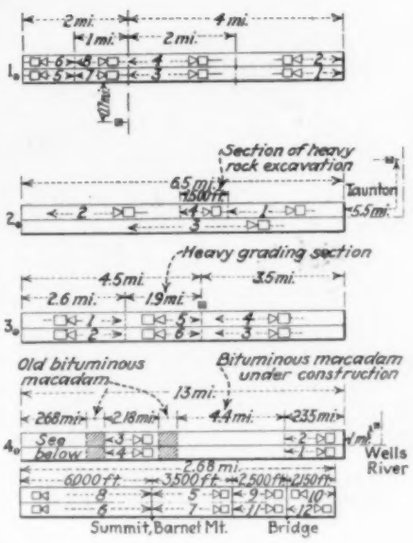


AUTOMATIC CALCIUM CHLORIDE CHARGER on Ransome mixer of Osborn-Barnes Co., works by gravity. Tank on skip fills when lowered and empties when raised. Man on platform is stirring calcium chloride solution in large tank. Miller Brothers' Construction Co. uses same type charger.



BAR MAT RESTS ON PIPES. Two 2-in. pipes attached to mixer support reinforcing steel for Sherry Construction Co. **METAL CLIP** *(right)* covers grooved top of metal joint until finishers lift it to edge joint and prepare for asphalt filler. Note bar mat supported by concrete.

PAPER BAGS *(left)* for cement are quickly opened with knife on Arborio Road Construction Co. job. Osborn-Barnes Co. also uses paper sacks. **DIAGRAM** *(below)* of sequence of paving operations and location of material-handling plant on each job.



half width at a time, while maintaining traffic. Trucks hauled to the mixers in all cases. The four contractors exhibited a common preference for Ransome 27-E paving mixers, Ord finishers, and Metaform road forms.

Both the volume of traffic and the amount of highway relocation affected the ease of hauling and the progress of the job. Where much of the paving was done on new location, traffic could be diverted over the old road, either eliminating travel past the mixer or reducing it to traffic in one direction. The first table gives the average number of vehicles passing through the job on a working day and the approximate percentage of relocation.

	Relocation, Per Cent	Traffic No. Vehicles in 12 Hours
1.	67.7	1,500
2.	1.7	1,200
3.	4.5	360
4.	20.0	500

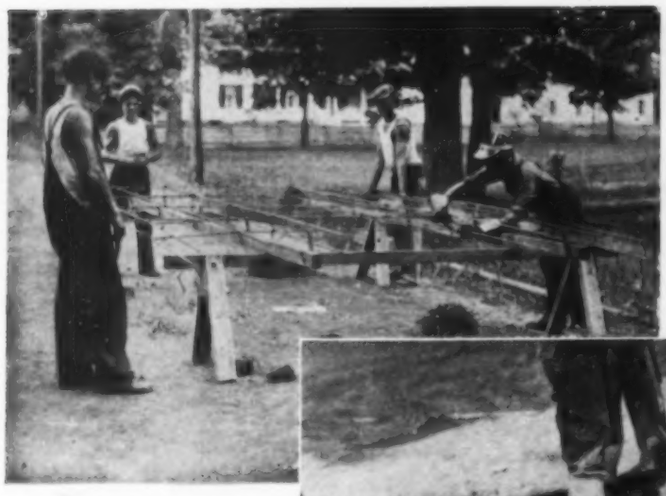
On Job 1, traffic traveled in only one direction past the mixer for much of the relocated portion. The final 2.68-mile section of Job 4 was paved in half widths, but without the traffic hindrance, as a detour was provided for this part of the project. The per cent relocation in the table does not include this 2.68-mile section. On this portion, however, long grades of more than 5 per cent and bridge construction made numerous moves of the paving mixer necessary.

Factors Affecting Speed—Other factors having a determining influence on job progress were the size of the batch, the delivery of batches to the mixer, the mixing period, the distance between expansion joints, the types of expansion joint, the kind of reinforcement, and the alignment and grade of highway. Most of these factors are set by state design and specification.

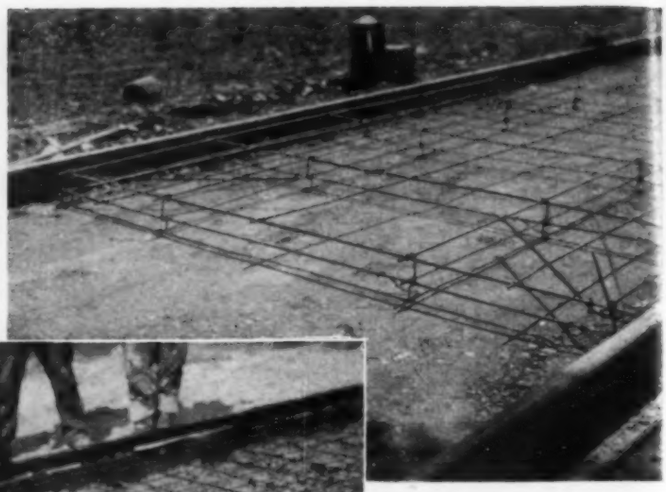
Three states required that forms be set 500 ft. in advance of the mixer. The Massachusetts requirement was 200 ft. Practically no delays resulted from failure to observe this specification.

Size of Batch—Concrete for the four jobs was proportioned on approximately the same formula of 1 : 2 : 3¼ to 3¾. Jobs 1, 2 and 4 mixed a six-bag batch; Job 3 used a seven-bag batch.

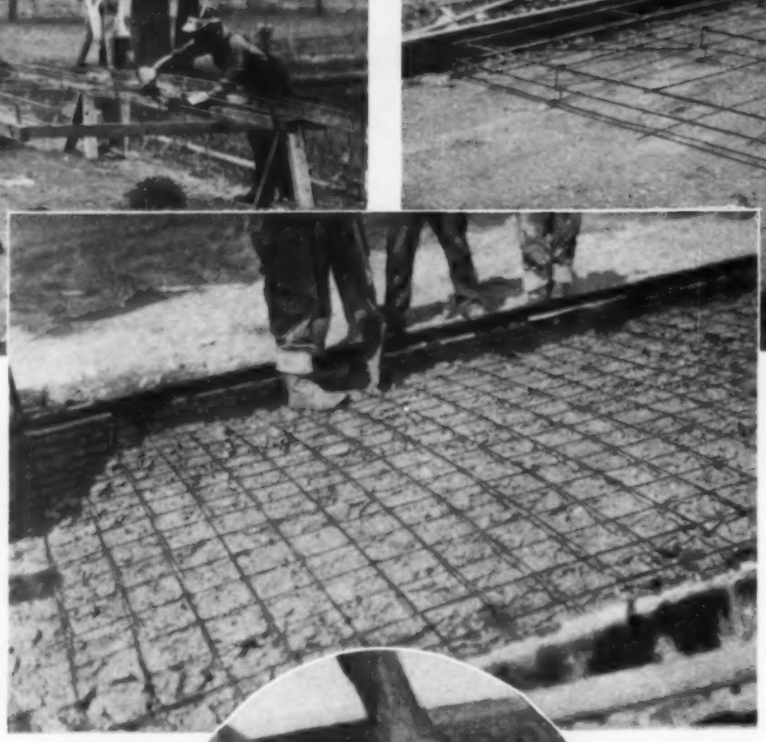
Delivery of Batches—Jobs 2, 3 and 4 produced their own aggregates



DOUBLE BAR MAT is fabricated by Miller Brothers' Construction Corporation with wire chairs and ties on special frame.



CHAIRS support double bar mat on subgrade. WELDED WIRE MAT *(left)* is laid on concrete leveled off by workmen of Arborio Road Construction Co.



WIRE TIES are used to make up bar mats.

at gravel crushing and washing plants. The Osborn-Barnes Co. used trap rock and sand shipped by rail to a material-handling plant. All four plants had ample storage capacity to prevent any delay due to lack of materials.

Length of dead haul and average haul on the four jobs was as follows:

	Dead Haul, Miles	Average Haul, Miles
1.	0.7	2.4
2.	5.5	8.5
3.	0.0	2.2
4.	1.0	8.2

All the contractors hired three-batch and four-batch trucks to haul to the mixers. On Jobs 1 and 2, the trucks were paid by the hour; on the other contracts, they operated on a piece-work basis.

On Jobs 2 and 4, the mixer moved in a direction away from the plant, permitting trucks to back into the skip without turning. The Arborio Road Construction Co. ran the mixer toward the plant and turned the loaded trucks without using a turntable. Connecticut specifications required the Osborn-Barnes Co. to pave upgrade where practicable. This requirement made it necessary to run the mixer both toward and away from the plant.

The diagram accompanying this article gives the locations of the batching plants in relation to the jobs and also the direction of paving operations in their numerical order.

Alignment and Grade—Features of

TRAFFIC CONTROL. Uniformed officer and distinctive telephone booth aid Miller Brothers.

importance which the diagram does not show are the curves and grades of the highways. The following table gives the percentage of superelevated curves and of grades of 4 per cent or greater:

	Superelevated Curves, Per Cent	Grades of 4 Per Cent or Greater, Per Cent
1.	35.3	50.7
2.	2.7	5.3
3.	35.0 (approx.)	8.2
4.	45.0	24.0

Mixing Period—The mixing period, or the time intervening between complete charging of the drum and the start of discharging, has a direct effect on progress. For the four jobs, it was as follows:

1.	2.	3.	4.
1¼ min.	1¼ min.	1¼ min.	1 min.

Expansion Joints—Distance between expansion joints did not vary greatly on the four projects. It is given in the following table, for subgrade built on loose material and on rock:

1.	2.	3.	4.
61.3 ft.	56.5 ft.	50 ft.	55 ft.
.....	.....	25 ft.	22 ft.

The joint material used on Jobs 2, 3 and 4 was the common premolded strip. This material required a temporary metal bulkhead and stakes to support it, as well as a metal clip to protect the top. On Job 1, however, Connecticut specified a metal type (the Truscon Air Cushion joint), containing an air space, to take care of expansion. This joint needed only stakes

to support it and required less time for its installation.

Three states used dowel rods between the two strips of pavement. The operations of placing the bars in the first strip and straightening them for the second caused occasional slight delays. Spacing of the dowels on the four jobs is given in the table.

1.	2.	3.	4.
No dowels....	5 ft.	3 ft.	2 ft. 10 in.

Reinforcing steel on three of the jobs consisted of bar mats made up in advance by the contractor's workmen. New Hampshire (Job 3) used a welded wire mat requiring no fabricating on the job.

Vermont's two-layer mat, with its chairs, was placed on the subgrade. On Jobs 1 and 3, the puddlers leveled off the concrete in the usual way to receive one-layer mats. Job 2 used a simple device to place the mat 2 in. above subgrade without leveling the concrete or using chairs. Two 2-in. pipes were attached to the mixer and were pulled along by it as it moved ahead. The mat was dropped on the pipes, and enough concrete was worked under the mat to support it before the mixer moved forward. Jobs 2 and 4 placed additional steel at the corners of the slab.

Progress—The following table gives the daily maximum and average progress of the four contractors:

	Maximum Progress, Lin.Ft.	Average Progress, Lin.Ft.	Average Progress, Sq.Yd.	Average Progress, Cu.Yd.
1.	1,532	1,158	1,286	285
2.	1,488	1,272	1,413	314
3.	2,256	1,700	1,888	330
4.	1,950	1,400	1,475	290

As the length of the working day varies somewhat with different contractors, it is even more important to know the rates per hour, as given below:

FREDERICK J. SHERRY, member of Sherry Construction Co.

	Maximum Progress, Lin.Ft.	Average Progress, Lin.Ft.	Average Progress, Sq.Yd.	Average Progress, Cu.Yd.
1.	124	113	125.5	28.0
2.	130	127	141.0	31.4
3.	200	150	166.6	29.2
4.	200	145	152.8	30.0

Curing Methods—The four states offered an interesting comparison of curing methods. Connecticut (Job 1) used a 2 per cent solution of calcium chloride in the concrete and covered the slab with burlap soaked for 36 hours. Vermont (Job 4) applied the same general method, except that the calcium chloride admixture was reduced to 1 per cent in hot weather and that the burlap was sprinkled for 48 hours. Massachusetts (Job 2) covered the green slab with burlap kept wet for the first day; the following morning, the burlap was removed and flake calcium chloride was spread in the amount of 2 lb. per square yard. New Hampshire (Job 3) spread hay 3 hours after placing the concrete and kept the hay soaked for 4 days.

Curing Period—All four states made beam tests to determine the strength of concrete. Three states opened slab to traffic after obtaining a specified modulus of rupture. The modulus of rupture required before opening is given in the table below, in pounds per square inch:

1.	2.	3.	4.
500	500	...	380

Taking all factors into consideration, a wide discrepancy is revealed in the length of time required for curing. The normal period was as follows:

1.	2.	3.	4.
48 hours	7 days	7 days	5 days

The table below gives the average curing period for the entire job:

1.	2.	3.	4.
60 hours	7 days	7 days	5 days

Job Managers—The men in charge were: Job 1, Connecticut, F. W. Disbrow, resident engineer, and Garfield Morrison, superintendent; Job 2, Massachusetts, H. O. Parker, district engineer, G. E. Foster, resident engineer, Arthur Cappler and Nathan Chace, superintendents; Job 3, New Hampshire, C. M. Brooks, division engineer, D. A. Proctor, resident engineer, and John Diminutto, superintendent; Job 4, Vermont, P. M. Stevens, resident engineer, and J. Davison, superintendent.

J. DAVISON *(left)* superintendent, Miller Brothers' Construction Corporation; and P. M. STEVENS, resident engineer, Vermont highway department.

GARFIELD MORRISON *(left)*, superintendent, Osborn-Barnes Co.; F. W. DISBROW, resident engineer, Connecticut highway department, and WILLIAM CRILL, mixer foreman.

D. A. PROCTOR, resident engineer, New Hampshire highway department, and JOSEPH COSTELLO, concrete superintendent, Arborio Road Construction Co.

Summer Graveling Follows

WINTER GRADING

of Maine Highway

WITH THERMOMETER AT 10 TO 15 DEG. BELOW ZERO, drillers *(in circle)* operate on large boulders which are strewn over whole length of job. TRUCKS *(below)* build 30-ft. fill which settles 6 ft. in spring.

CONSTRUCTION of the Wyman Dam by the Central Maine Power Co. has compelled the relocation of the Bingham-Jackman highway for about 12 miles north of Bingham, Me. The power company completed the grading and graveling of approximately 4 miles nearest the dam in 1929. During 1930, W. H. Hinman, Inc., of Skowhegan, Me., built the remaining 7½ miles of new location at an average elevation 125 ft. above the old road. The state highway department oiled the first 4 miles last summer, and will oil the 7½ miles this summer.

Construction Quantities—The new road has an 18-ft. graveled surface, with 3-ft. shoulders. Construction of the 7½ miles in the Hinman contract involved the excavation of 160,000 yd. of earth and loose rock, 10,000 yd. of rock, and 20,000 yd. of borrow. An 8-in. gravel base contained 15,000 yd. of pit-run material, and the 4-in. top course required the screening and spreading of between 6,000 and 7,000 yd. of gravel passing a 1¼-in. sieve. Bridges, culverts, and retaining walls took 3,000 yd. of concrete, and protection of fills against wave action of the lake called for 3,000 yd. of riprap.

STEAM HEAT keeps camp buildings comfortable during cold weather.

Mr. Hinman started construction on January 2 and practically completed the road by September 1. Final dressing had been given the project by October.

Winter Conditions — Freezing temperatures during the first months made construction conditions somewhat different from the usual. Camp buildings for 60 to 70 men were hauled on sleds from the power company's completed section to the new site. A boiler fired with wood from the 55 acres cleared on the right-of-way heated the camp with steam, and a garage protected the fifteen 4½-yd. trucks from the weather.

Gasoline power shovels on crawlers did the excavating. The difficulty of supplying coal and water would have

IN TIME OF PLENTY, contractor prepares for want. Ice stored during winter will keep refrigerator cool in summer.

SCOTT STUART *(at extreme left)*, of Stuart & Williams, and J. S. BROOKS, of W. H. Hinman, Inc. *(In group of four, left to right)* PHILIP V. COREY, W. H. HINMAN, R. M. WALTON and CHARLES BESS, of W. H. Hinman, Inc.

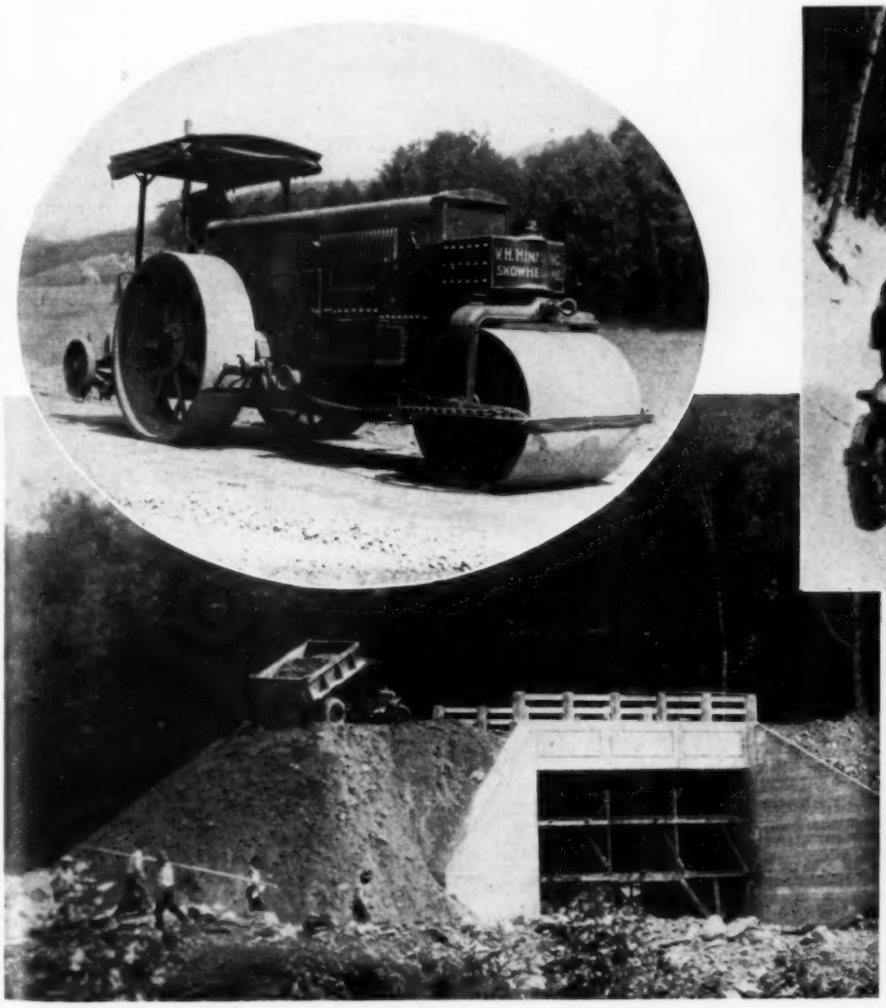
made steam shovels impractical. A two-horse team employed on the job for 8 weeks dragged gasoline drums to the shovels. Where the team could not function, men carried the fuel in tanks.

Moving Shovels — Crawler treads under the shovels were fitted with cleats for travel on the icy, snow-covered slopes. Thus equipped, shovels climbed a 40 per cent grade in one place by moving in reverse, using the dippers to push and blocks and tackles to pull, in addition to their tractions.

During cold nights, the shovel motors were kept running, as also were the motors of trucks when they had to be left on the job. Glycerin, alcohol and Prestone lowered the freezing temperatures of the cooling liquids in the radiators. In many places, the shovels pulled trucks on to the grade. A cable from the shovel drum was used in one case; but usually the shovel hooked to the fall of a block and tackle and moved over the grade to pull the truck.

The portable compressors were kept close to the jackhammer drills to prevent loss of pressure and freezing in the pipe lines. Workmen sealed drilled holes carefully to keep out water from melting snow on slopes above.

Equipment—W. H. Hinman, Inc.,



CAMP BUILDINGS travel to new site on skids behind motor trucks.

ROLLER *(in oval, above)* compacts gravel base and surface. FILL APPROACHING BRIDGE *(left, below)* is extended by end-dumping from trucks. T-beam bridge is 30 ft. in height.

GASOLINE POWER SHOVELS *(left)* **carry on work during coldest weather. For traveling on slippery slopes, crawler treads are fitted with cleats.**

FIFTEEN 4½-YD. TRUCKS haul material excavated by five power shovels.

operated the following equipment on the job:

4 Bucyrus-Erie 1-yd. gas-air shovels
1 Lorain 1¼-yd. gasoline shovel
15 Sterling 4½-yd. trucks
1 Ingersoll-Rand three-hammer compressor
1 Ingersoll-Rand two-hammer compressor
1 Ingersoll-Rand one-hammer compressor to run sharpening equipment
5 Ingersoll-Rand S-49 jackhammer drills
1 Barber-Greene screening and loading machine
1 Wehr blade grader
1 Russell motor grader
1 Caterpillar 20-hp. tractor
2 Buffalo-Springfield 14-ton rollers
1 Boss one-bag mixer

Cuts and Fills—The location of the new road is along the slope of a rather steep mountain. Most of the earth-moving was sidehill cut and fill. In some places, slopes ran back over 100 ft. from the center line. Although the slopes were reduced from 1½:1 to 1¼:1 in order to bring them out on the mountain side, in a few places even the steeper slope would not come out. The contractor made 30 per cent of his fills in cold weather. Fills 30 ft. high settled 6 ft. in the spring.

PORTABLE SCREENING AND LOADING PLANT *(below)* **produces as much as 400 yd. of screened surface gravel per day. REVOLVING DISK** *(right)* **feeds bucket chain.**

Gravel Production—After the 8-in. pit-run gravel base had been spread and rolled, the trucks distributed the 1¼-in. gravel for the top. This top material contained natural binder. The Barber-Greene screening and loading machine produced all the surface gravel. When working against a high bank it was able to load as much as 400 yd. per day. The gravel deposits gave a high yield for this use, the proportion of screenings to tailings running as high as five to one.

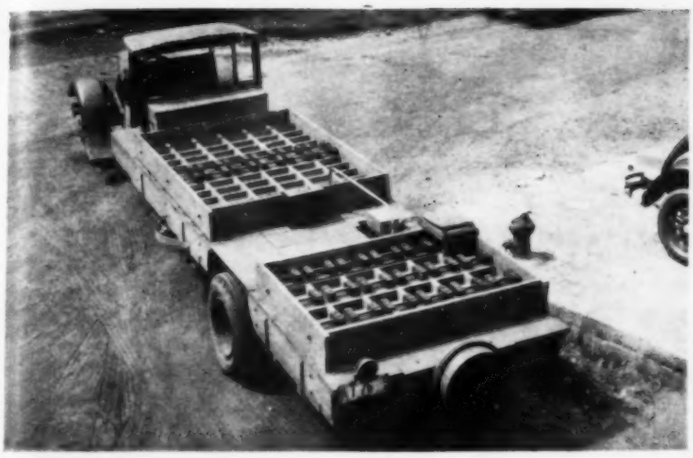
Concrete Work—Mr. Hinman constructed five concrete retaining walls, two on the upper side of the road and three on the lower.

Stuart & Williams, of Augusta, Me., took a sub-contract to construct two T-beam concrete bridges. The larger of the two was 30 ft. high and contained 450 yd. of concrete.

Job Managers—For the first part of the job, R. M. Walton was general superintendent for W. H. Hinman, Inc., with Charles Bess as superintendent. After these men had been transferred to take charge of other work for Mr. Hinman, Philip V. Corey was in charge as general superintendent, assisted by J. S. Brooks, superintendent and engineer, and Dewey Rice, superintendent. L. L. Alden was resident engineer, acting under Lucius D. Barrows, state highway engineer.

JOB ODDITIES

A Monthly Page of Unusual Features of Construction



TO TEST IMPACT of heavy vehicles on concrete pavement at Aberdeen (Md.) Proving Ground, U. S. Bureau of Public Roads uses this specially equipped bus chassis.

Photo Bur. Pub. Roads

HANGING BY AN EYELASH. Drillers in harness lashed to ¾-in. Hercules wire rope form nose of George Washington for Mt. Rushmore monument in South Dakota.

©P&A

EX-CHAMP IN CONSTRUCTION ROLE. Jack Dempsey, former world's heavyweight title holder, takes a hand in grading the site for his Playa de Ensenada hotel and casino project in Lower California.

PACK HORSE solves problem of advancing burlap for curing concrete road in Tennessee mountains, where widened curves and lack of shoulder room ruled out other methods. *Photo by* JOHN F. SULLIVAN, *Junior Engineer, U. S. Bureau of Public Roads.*

©P&A

TICKETS FOR SLOW POKES. To relieve traffic congestion on the Newport News-James River Bridge at Norfolk, Va., drivers of automobiles must maintain a speed of at least 40 miles per hour.

The Superintendent Tells

How to Stop Overruns *in Building Concrete Roads*

BILL, the superintendent, had just checked up on the day's run. It was good—1,276 ft. At least, everyone except Bill thought it was good. But Bill was looking a bit worried. And he was still pondering over the matter when Jim Anderson, the general superintendent, dropped in.

"Figures don't lie," was Bill's comment when Jim asked what was worrying him. "We got 1,276 ft. of pavement today. That looks pretty good. But we poured 502 batches. The chief inspector says we ought to get 2.7 ft. per batch and, as I figure it, that's about right. That would make 1,355 ft. We should have poured only 473 batches to get that 1,276 ft. and that means we have lost 29 batches somewhere. What's more—and this is the thing that's worrying me right now—the inspectors have just cored some of the pavement we laid last month and found four or five cores anywhere from ¼ to ¾ in. shy. I simply can't understand it. We are using nearly 6 per cent more material than the estimate called for—which is bad enough—and in spite of that more than 10 per cent of the cores are short. Now, what's the answer?"

A Few Paving Kinks

Jim smoked a while as he turned the problem over in his mind.

"Bill," said he, "you are still a youngster and there are a lot of kinks in laying a concrete pavement. Of course, you are pretty sure the subgrade is cut right?"

"Absolutely," was Bill's prompt reply. "You know we have the best subgrade planer there is on the market. The grading gang is working well and the planer doesn't have much material to take off. Moreover, the ground is easy to work. There can't be any trouble there."

"Sounds all right," commented Jim. "But does the blade cut all the way across, all the time?"

"No," replied Bill, "that makes it pull pretty hard, you know, so we have the subgrade gang work as close to grade as possible without putting too much of a load on the planer."

"Sure," was Jim's laconic observation. "But, you know, if the blade doesn't cut, that means there is a low spot in the subgrade. Some of those 29 extra batches must have gone into those low spots. True enough, the planer is supposed to fill low spots, and it does to some extent, but when the loose earth left in these low spots is sprinkled, it is apt to settle quite a little. You lost 29 batches today out of 502 batches, about 6 per cent. That means the pavement is averaging about ½ in. too thick. A little of it is going into the low spots in the subgrade, the spots which the blade on the planer clears, but there must be something else, for that could hardly cause so large a loss of material. Do you load the planer at all to hold it down? You know it isn't designed to carry a load?"

Loading the Planer

"Never thought of that," replied Bill. "As a matter of fact, the planer is loaded with eight sacks of sand, some 700 or 800 lb. And then, when the cutting is a bit heavy, the men—five or six of them—get on to it and ride it to hold it down. I've often noticed that when the inspector sends it back for a second or even the third forward trip over the subgrade we put a lot of men on it. It isn't possible that the frame bends under that sort of a load, is it?"

"Not so much with the newer planers, which are pretty heavy, but I've seen some of the older types bend as much as ¼ in. at the center," Jim replied. "If the planer you have bends only $\frac{1}{16}$ in. that is something. We're looking for only about ½ in. and even $\frac{1}{16}$ in. is a substantial part of such a loss. It might not be a bad idea to check the set of the blade on your planer with those eight sacks of sand on it and then with an extra load about equal to the weight of the men who usually ride it, to see just how much it does bend. You have a new planer and it may not bend enough to do any harm. But again it may—and it may be pushing the forms down a bit too. Half a dozen men and eight sacks of sand is quite a load!"

"Then, again," Jim continued, "the blade wears rather rapidly. Of course, that tends to make the machine cut the subgrade a little high. It's a pretty good plan to reset the blade for each mile of pavement. Cutting subgrade, particularly if there is any sand in it, is hard on the blade. As a rule, a good deal more of the area of the subgrade is low than is high. One could reason that a worn blade only tends to average this out a bit more accurately, but the people who are buying these pavements don't want thin spots in them and so we don't want thin spots in them. We want the blade set as near right as possible. We can't get away from the fact, you know, that a worn blade does cut the subgrade too high and that does tend to produce short cores.

"All right, we'll check up on this bright and early tomorrow morning," was Bill's comment. "But that doesn't explain those 29 batches."

"It doesn't," replied Jim. "As a matter of fact, my experience is that high subgrade is the smallest factor in the situation. One thinks of it first because inspectors are forever talking about it and watching for it, and they are not very far wrong at that, for it is easy to get careless in handling the subgrade. But most of the men

who are building concrete roads are careful about their work on the subgrade, so usually both thin pavement and thick pavement are the result of causes not so obvious as the condition of the subgrade at the mixer usually is."

"Now, for instance," Jim continued, "it just happens that I have never had and inspector check up on the finishing machine after he had once O.K.'d it. It is a pretty sturdy piece of equipment and it is quite true that the screeds do not get out of adjustment very easily. Still, it does occur. Of course, the screeds wear a little, but the slide plates wear a good deal. This naturally changes the shape of the road surface slightly but its principal effect is to bring the center of the screeds correspondingly closer to the subgrade which, of course, tends to reduce the crown thickness a little. An eighth of an inch is a common loss on account of worn slide plates and as cores are apt to be taken near the center of the pavement, it has always seemed to me that they tend to reflect the effect of using worn slide plates to a degree that is rather out of proportion to the actual effect of this practice on the general thickness of the pavement.

"Now, while worn slide plates tend to reduce the amount of concrete used, it sometimes happens that the arc at which the screeds themselves are set is incorrect, and this increases the amount of material used. A parabolic arc differs quite a little from a circular arc. The crown of the pavement we are now laying is an arc of a circle. The crown of the pavement on which the finishing machine was last used was a parabolic arc—flatter at the center with a more rapid drop to the edges. Did you have the screeds reset when this job was started?"

How About the Forms?

Bill thought for a moment or two. "No," he replied. "I don't believe the screeds were reset. The inspector checked the crown and found it correct, but I don't believe either of us thought of checking any further."

"Quite likely," Jim commented. "We'll look that over in the morning along with these other matters. And, another thing, how about the forms? Are they set high?"

"Yes, ¼ in. The inspectors have asked us to do that," Bill replied.

"And the planer is set accordingly?"

"Yes."

"Of course, the finishing machine does cause quite a little form settlement, particularly with some types of forms and on some types of soils. But did you ever check the forms after the finishing operations had been completed to see whether the forms were settling that much on this particular job?"

"No," Bill replied. "I never have."

"You know," Jim continued, "form settlement is a thing that has to be watched carefully. We want to give all we have contracted to give, but prices are close and a 6-per cent overrun means real money. In the early spring the ground is soft and forms often do settle ¼ in. During the summer and fall, however, the ground is a good deal more solid and as a rule well-set forms do not settle an average of ¼ in. What's more, if the forms are well tamped and the sprinkling is done in a way that avoids getting a lot of water under the edge of the form, there isn't any settlement.

"You know, too, that our instructions are rather definite on that point. The man who sprinkles the subgrade must not throw a lot of water against the forms and must not sprinkle so heavily along the edges of the subgrade that water will run down to the forms. If it does, it is certain to soften the material which has been tamped under the edge and if this is softened, the form naturally will not hold when the finishing machine reaches it."

Sagging Template

"Well," Bill replied, "we have always followed that order, but I never did see the sense in it before. I wonder if our overrun isn't due to the fact that our form settlement is less than is allowed for?"

"Very likely," Jim replied. "But there is another matter which may also need a bit of consideration. You set the forms as accurately as possible, of course? Then you finish the subgrade with a standard subgrader?"

"Yes."

"Then you roll the subgrade?"

"Yes."

"And then you re-run the subgrader?"

"Yes."

"After which you check the whole surface with a template?"

"That's right."

"Is the template correct?"

"Absolutely—checked it only yesterday."

"Laid it on the ground to check it?"

"Certainly."

"Did you check it for sag? You know, 18 ft. between supports is a good deal."

"No, I never thought of it sagging."

"The men sometimes sort of ride it as they push it along don't they? Is it heavy enough so that it can stand such use without bending?"

"Perhaps not. It is a bit light, come to think of it, and any bending would mean low subgrade."

"Yes, the places the planer doesn't cut. And then, another thing," Jim continued, "when does the inspector

check up on the forms? After all of these things are done?"

"As a rule," replied Bill,. "He needs a good clear space in which to work."

"True. He does need that, and we ought to see that he gets it. But, Bill, how does he go about adjusting the forms? Does he select a couple of spots from which to work and then have the men pry up low forms and pound down high spots until he has a satisfactorily alignment?"

"Yes, and he surely is particular about it."

"Well, he ought to be. That's what he's there for, at least one of the things, and we can't object to his doing a good job. But how much does he move the forms?"

Resetting the Forms

"Usually not much. As a rule, he raises more than he lowers, though. Probably that is the easier way to make the adjustment. Then, too, the subgrader is pretty heavy and most of the forms which are out of grade are forms the subgrader pushed down."

"So, as a rule," queried Jim, "the inspector raises the forms as he checks them?"

"Yes."

"Then, Bill, his work tends to throw the subgrade out and usually tends to make it too low as compared with the tops of the forms."

"As a rule that would be the case."

"Then, wouldn't it be a pretty good thing to run that template after he has checked the forms, instead of before he checks them?"

Bill pondered a moment before replying. "It sure sounds as though it might. But it would be a lot of bother to do it that way. They might even make us re-roll."

"Possibly," commented Jim. "And if so, it would be necessary to re-check after the rolling. But 29 batches of concrete costs a good deal more than that would cost."

"Well, Jim," said Bill, "with all these pointers it ought to be possible to get rid of that overrun, but how about those short cores? I don't see how it is possible to have both an overrun and a lot of short cores on the same job, particularly when we are all as careful as we are on this job. Then, even if we were careless, which we aren't, the inspectors watch the work all the time. They are as much in the dark as we are. They are talking about raising the forms a little higher. What can we do to get away from those short cores? The inspectors are a fine bunch and want to give us every bit of assistance they can. But the head office doesn't like short cores and goes after them pretty hard when any show up. That is right enough, too. But we can't afford to use any more concrete than we are using now. We ought to be using less. They don't like thin spots in the pavement and neither do we. How can we use less concrete and still get fewer short cores?"

Constant Adjustment

Jim took a puff or two on his pipe before speaking. "You know," he finally began, "laying a concrete slab of full thickness with no thin spots and no extra concrete is a mighty difficult job. In fact, it's pretty nearly an impossible job, though it can be done. Of course the planer must be set right and must be kept right. We have discussed that. The blade will wear down. As it does, so the subgrade comes up. The only answer to that is constant adjustment—readjustment after every mile or so of slab laid.

"We have also mentioned the finishing machine. The slide plates must be changed rather often. Otherwise the pavement is pinched down at the crown. An eight of an inch on the planer blade and an eighth of an inch on the slide plates will make the center of the pavement a quarter of an inch thin even if everything else is absolutely correct.

"We have also mentioned the forms. They ought to be put down so solidly that they will stay where they are put, but this is pretty hard to do. We are going to try to find out just how much the forms are settling on this job—not much I fancy from what I know of conditions here—but it is impossible to avoid all form settlement. This would not be so bad if the settlement were uniform, but if we find when we check up on it that the usual settlement is under $\frac{1}{8}$ in. we are also pretty certain to find that in occasional instances the settlement will be over $\frac{1}{4}$ in. Suppose, to be safe, we set the forms $\frac{1}{8}$ in. high. We still face the fact that once in a while, probably a few times every day, some workman will do a little careless tamping and a section or two of the forms will drop $\frac{1}{4}$ in. Naturally, a thin spot in the pavement is the result.

Some Batches Too Wet

"On most jobs a batch which is too wet gets by now and then. It is hard to avoid this because there is a good deal of variation in the amount of moisture the materials carry. Sometimes the mixer operator makes a mistake. A wet batch will settle more than a normal batch. A batch has to be pretty wet to settle $\frac{1}{8}$ in. but concrete as wet as that will get by now and then. Of course, the answer here is the same as the answer to the form question—more care. We have contracted to build a first class piece of work and it is up to us to look out for these things. It's in our interest to do so, too, for the same sort of care which is needed if we are to reduce the overrun will also eliminate the things which cause the short cores."

"Perhaps," Jim continued, "we ought to dry up all the concrete a little. I notice all of the short cores came from close to the center of the pavement. Wet concrete doesn't stay put as well as fairly dry concrete does; sort of slumps down toward the forms. I have seen a lot of jobs where the concrete would rise up at the forms $\frac{1}{4}$ in. or so after the finishing machine had left it. The stuff has to come from somewhere, you know. Usually it flows from the center to the forms and leaves the center a little thin. When concrete does that it is well to try to get along with a little less water. The men may object at first, but they will get used to it.

The Hand Finishers

"And, while we are on that, we mustn't overlook the hand finishers. It's so much easier to rake off a high spot than it is to fill up a low spot that this will always bear watching. Also, some finishers have a tendency to work their tools harder when pulling toward the forms than when pushing toward the center. This naturally tends to drag material away from the center of the road. The effect isn't great but it doesn't have to be great. If half a dozen things are in error by only $\frac{1}{8}$ in.—not much of an error on work of this sort, it must be admitted—it still remains that all of these errors *can* occur at the same spot and that, therefore, the pavement *can* be thin there by as much as $\frac{3}{4}$ in., even though the subgrade was accurately cut in perfect relationship to the forms to start with. True enough, these things usually do not all come at the same place. But they *can* all come at the same spot and when they do the pavement is thin.

"The answer? Care, constant meticulous care as to detail—constant attention to the equipment—constant watch to see that the men on the job do their work correctly. It's our business to take care of this, Bill. We are here to do a good job as well as to make a profit—and on this sort of work the two run mighty close together."

Bill had ceased to look worried. "Come on," he remarked, "let's turn in. I can see that we have a busy day ahead. But I feel a lot better. I've been working at this thing in the dark and getting nowhere, but I'll bet that with this dope we can stop that overrun and also get rid of those short cores!"

OILING AND MIXING

Produce Surface Mat on Nebraska

FINE SAND ROAD

UNDER the joint supervision of the Nebraska Department of Public Works and the U. S. Bureau of Public Roads, the Central Bridge & Construction Co., of Wahoo, Neb., has constructed a 4-in. mixed-in-place bituminous surface mat on 9½ miles of fine, wind-blown sand road south of O'Neill, Neb. For purposes of experiment, the project was divided into ten numbered sections, nine being 1 mile long and one, ½ mile in length.

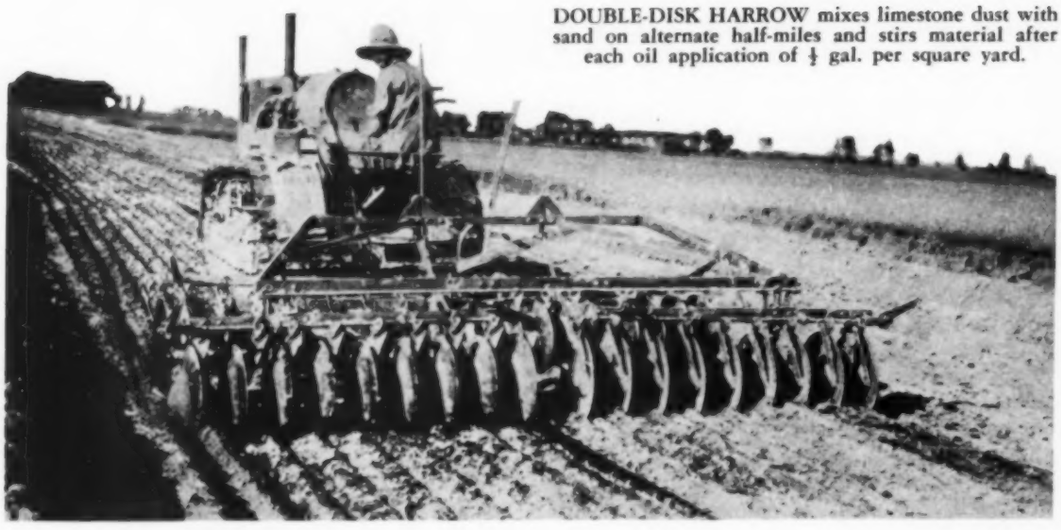
The natural subgrade material consists of fine sand on the greater portion of the project, from 25 to 50 per cent of it passing a 100-mesh sieve. On part of the project, some silt and clay was mixed with the sand during construction of the subgrade.

Limestone Dust Added—It was decided to add 3 per cent of limestone dust, of which 85 per cent would pass a 200-mesh sieve, to every alternate half-mile. Laboratory tests indicated that the addition of limestone dust increased stability of the mat.

The total quantity of oil applied was 4 gal. per square yard, or 1 gal. for each inch of depth. Each of two 2-in. courses composing the mat was oiled and mixed separately. A pressure distributor spread the oil for a 2-in. course in four applications of ½ gal. per square yard each. After each application, a double-disk gang plow harrowed the material.

Three Types of Oil—On sections 7, 8 and 9, the contractor applied a cutback product. The base material of the cutback product was an oil containing not less than 95 per cent asphalt having a penetration of 100. To this base was added enough kerosene to cut it down to workable consistency.

SEEDER, pulled by truck, distributes lime-stone dust on alternate half-miles. Truck carries bags of dust. FINE, WIND-BLOWN SAND *(in oval, above)* is natural subgrade material on greater portion of project.



DOUBLE-DISK HARROW mixes limestone dust with sand on alternate half-miles and stirs material after each oil application of ¼ gal. per square yard.

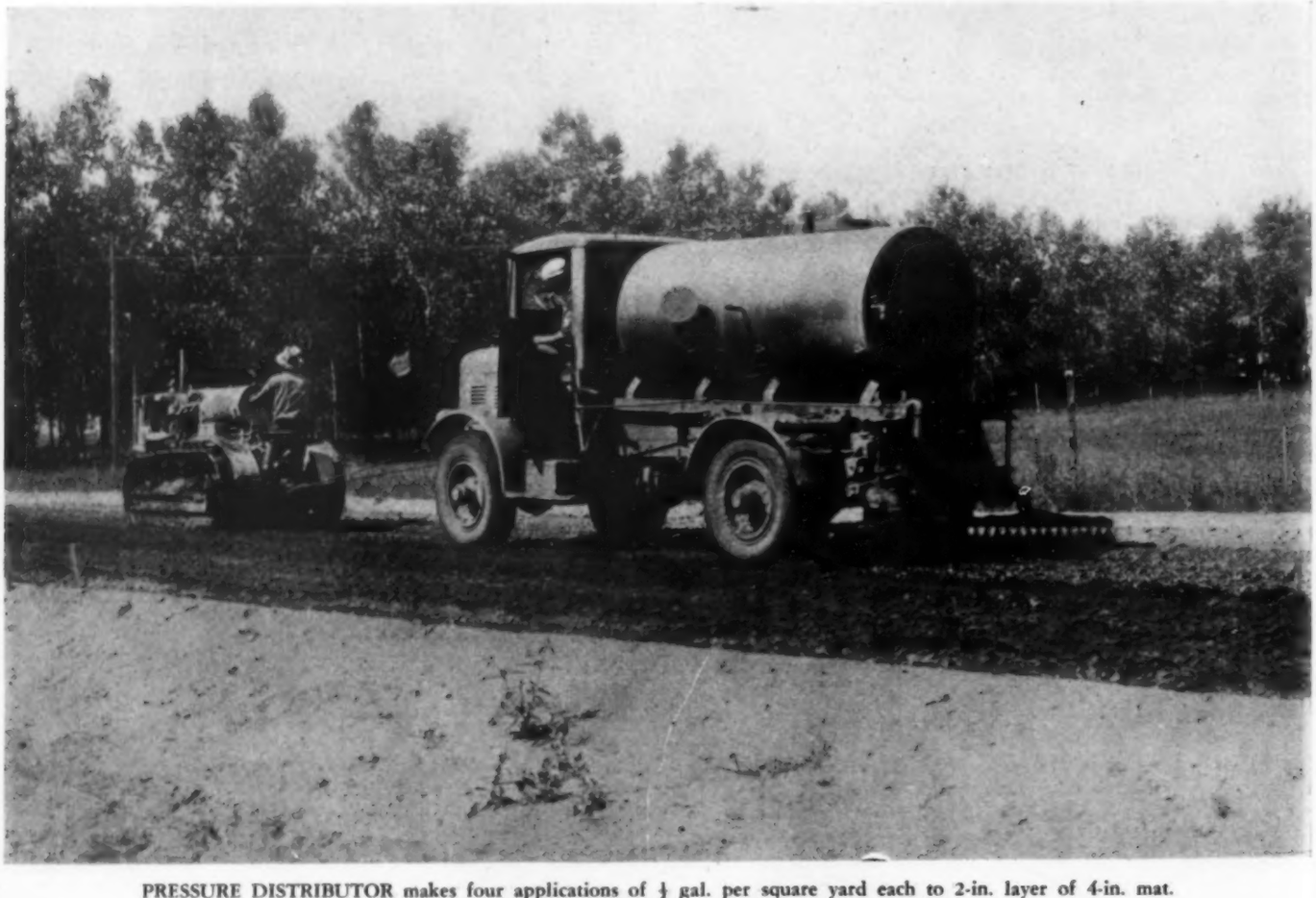
The resulting product contained between 70 and 80 per cent asphalt of 100 penetration.

The oil used on sections 1, 4, 5, 6, 10 and one-half of 2 was the same type applied to sections 7, 8 and 9; but it was composed of slightly different materials, the base being an asphaltic cement having a penetration of from 100 to 120. This cement was cut back to workable consistency with kerosene, the resulting product containing between 75 and 80 per cent asphalt having a penetration of 80.

On section 3 and one-half of section 2, the bituminous binder was a straight-run or residual road oil containing betwen 60 and 70 per cent asphalt of 100 penetration. The mat formed with this material is not satisfactory, because the mixture refuses to set, remaining soft and sugary.

Equipment and Methods—In constructing the 4-in. oiled sand mat, the Central Bridge & Construction Co. used the following equipment:

2 Etnyre 600-gal. pressure distributors
1 boiler for heating oil
1 McCormick-Deering seeder 8 ft. wide
1 Rock Island double-disk harrow
4 30-hp. Caterpillar tractors
3 blade graders
1 power grader
1 drag
2 trucks to haul limestone



PRESSURE DISTRIBUTOR makes four applications of ¼ gal. per square yard each to 2-in. layer of 4-in. mat. Crawler tractor draws distributor to avoid excessive rutting.

IN CHARGE OF EXPERIMENT. *(Left to right)* **E. F. Kelley, chief, Division of Tests, U. S. Bureau of Public Roads; W. H. Bauman, district engineer, Nebraska Department of Public Works; S. E. Sime, materials engineer, District 5, U. S. B. P. R.; M. S. Dodd, project engineer, Nebr. D. P. W.; P. F. Critz, associate highway engineer, U. S. B. P. R.; C. V. Johnson, senior highway engineer, U. S. B. P. R.; Clifford Shoemaker, district engineer, District 5, U. S. B. P. R.**

After 2 gal. of oil per square yard had been applied and disked into the sand of the first course, the material was bladed into a windrow by tractor-drawn graders. The blade graders rolled the windrow from side to side until a uniform mix was obtained and then spread the material evenly over the subgrade. More sand was spread on top of the mixture, and the distributors applied 2 gal. to this upper layer. The blade graders repeated the mixing process until the material showed uniform color and texture to a minimum depth of 4 in.

A McCormick-Deering seeder spread the limestone dust on the half-miles where it was used. Although the seeder was slow, it distributed the dust uniformly. Two men often rode the machine to keep the dust flowing freely through the worm distributor. The limestone dust was thoroughly disked into the sand before the oil was applied.

Traffic compacts and irons out the mat after the material has been mixed and dragged smooth. A portion of the project constructed in the fall of 1929 is hard and firm and has a satisfactory riding surface which is not slippery when wet.

Personnel

M. S. Dodd is project engineer for the Nebraska Department of Public Works, acting under A. T. Lobdell, chief of the Bureau of Roads & Bridges, and W. H. Bauman, district engineer. For the U. S. Bureau of Public Roads, P. F. Critz, associate highway engineer, is in charge of field operations. Other members of the state and federal engineering personnel are shown in the accompanying picture.

BLADE GRADER mixes oiled sand until material attains uniform color and texture. BLADE *(right)* **turns material in mixing it. Number of turns for 2-in. layer varies from 20 to more than 150.**

How Tennessee Maintains a 25,000-Mile

GRAVEL ROADS

MORE than 25,638 miles of graveled roads are maintained for all-weather service by the Tennessee State Highway Department by the constant use of one-man motor-driven blade machines. This extensive gravel road maintenance program was adopted to meet two general conditions: One was the necessity of handling traffic more or less temporarily on newly-graded primary highways that are later to be hard surfaced; the other is the provision of all-weather service on roads that are not likely to be permanently improved for some time.

Comparatively simple methods of placing the gravel and of maintaining it have been developed by the department. Recently a large mileage of unimproved county roads was added to the system. Some plan had to be devised promptly for getting them into shape and then of maintaining them. Available funds required limited expenditures, particularly for construction. Previous experience indicated that light gravel surfacing, properly maintained, would solve the problem.

Plentiful deposits of gravel that can be used as pit-run occur in most parts of Tennessee. Elsewhere good chert generally is available. Soil conditions cover a wide range from almost solid rock in the eastern mountains to the alluvial silt of the western part. Rainfall is everywhere copious, with a maximum of 65 in. in the mountains, and 55 in. in the central part of the state. Heavy rains of long duration also are not uncommon. On the other hand, excessively dry weather has been experienced at times in recent years. Frost introduces a major highway problem, since there are frequent periods of freezing and thawing. The ordinary maximum depth of frost in the soil is about 1 ft.

Under these conditions the maintenance of light gravel roads to carry year-round traffic is not simple, even on routes of light traffic. On the main highways only constant maintenance keeps them in shape for continuous use. Gravel surfacing is kept on these latter routes, of course, only until the fills have consolidated completely. Meantime, the whole of a grading project remains unpaved and not merely the gaps where the fills occur.

Long, high fills are common in the central and the western parts of the state. Conditions have made the use of dragline excavators the only procedure in a few cases. Hence, the settlement is great and permanent surfacing cannot safely be laid on them for at least two years. During that period temporary thin graveling carries traffic without interruption.

ONE-MAN GRADER *(above)* **on gravel road maintenance covers section from 12 to 25 miles long.**

WINDROW *(left)* **of shifting gravel is maintained at height of from 3 to 6 in.**

State-Wide System of

AT LOW COST

Prior to placing gravel surfacing, the department shapes the soil surface properly to get quick removal of rainfall. Ample side ditches and drainage are provided to keep the ground-water level below the road surface.

Methods of excavating and delivering gravel to the roads vary. Light dump-trucks make the haul, end-dump bodies being used wherever available. With this type of body good enough distribution of the gravel is possible to permit the blade machines to finish the job. When the gravel is dumped on the road in piles, the blade machines are used to shift it all to the side, clearing it right down to the natural soil. Otherwise, compact spots occur in the finished gravel surface wherever the piles occurred, with loose spots between.

Regular practice calls for about 700 tons of gravel to the mile on an 18-foot roadway. This gives an average of 3 in. of material. Where weak subgrade spots occur more gravel is allowed.

Promptly after the gravel is placed it is spread uniformly with a blade machine. No rolling is done. Instead, traffic is depended upon to consolidate the gravel. At first, a considerable part of the gravel is kept moving across the road by constant blading.

F. W. WEBSTER, assistant engineer in charge of maintenance.

As the traffic beds the gravel, the proportion of floating material is reduced. But even after a road has long been in use, care is taken to have quite a bit of loose gravel This loose material is moved back and forth across the road by constant blading

R. H. BAKER, State Commissioner of Highways and Public Works.

This procedure leaves a windrow of gravel at the center line of the road nearly half of the time On recently metalled routes this center windrow is as much as 6 in. deep. In a few cases it is less than 3 in. A trip of several hundred miles over roads handled in this way at speeds up to 50 miles an hour showed that traffic is not hindered by this central windrow. Nor does the experience of the department indicate that this feature is hazardous.

On heavily traveled routes that have been graveled temporarily, dust is a problem. This situation has been relieved by the use of calcium chloride. In most cases, however, no treatment is used.

E. L. COILE, assistant maintenance engineer, Tennessee Highway Department.

On routes carrying 300 vehicles or more a day, one man with a motor-driven blade grader is given 12 miles of road to maintain. Where the traffic is less than that, the mileage per section is increased to a maximum of 25.

On short sections the maintenance man covers his entire 12 miles of road every other day. The machine goes up one side of the road one day and back on the other side the next. On the up trip the loose gravel is pulled to the middle of the road. On the down trip the next day this loose gravel is moved across to the opposite side. This procedure results in a remarkably smooth surface that is entirely free from chatter bumps.

On the average about 1 in. in depth of the material is lost each year. This loss is replenished by roving truck crews.

The cost of maintaining these thinly graveled roads ranges from $400 to $900 per mile per year, with an average of about $600 for the 25,638 miles under maintenance in this manner. These costs are considered fully justified by the two main results accomplished. In the first place, they have provided all-weather roads practically to the entire population of the state without a great initial outlay. Particularly have the isolated sections been thus benefited. In the second place, this policy permits traffic to be carried with reasonable satisfaction on newly graded heavy-traffic routes until it is entirely safe to place hard surfacing on the fills.

Robert H. Baker is commissioner of highways and public works of Tennessee, T. C. McEwen is state highway engineer, and Frank W. Webster is assistant state highway engineer in charge of maintenance.

Sheet Asphalt Mix Delivered Hot After

42-Mile Truck Haul

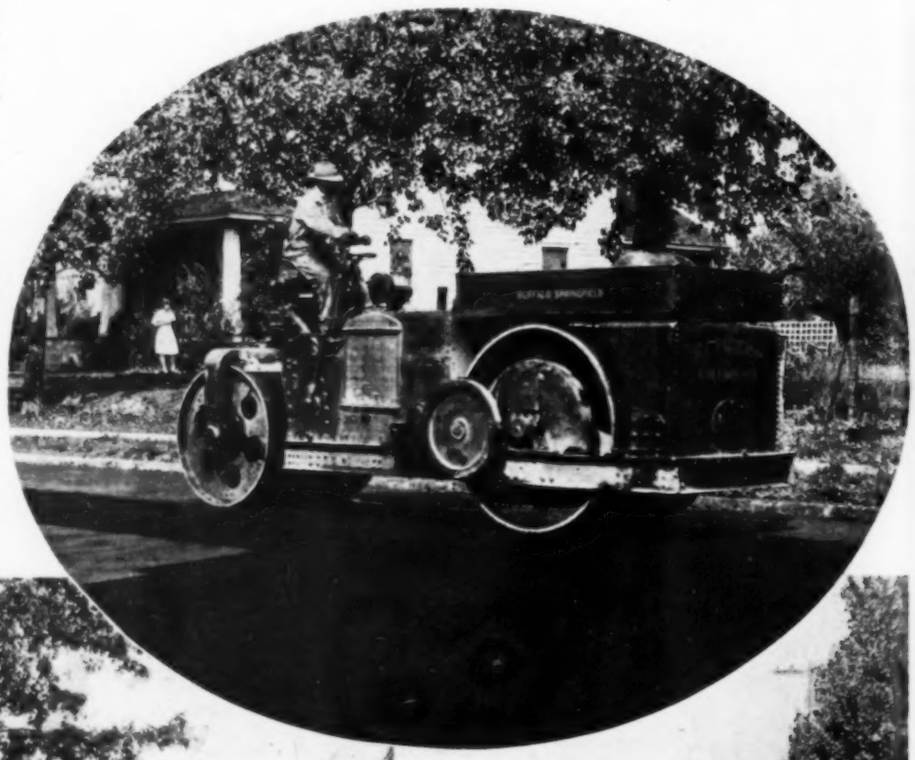
By EARL V. MURRAY
State Highway Department of Ohio

WITH a fleet of 25 speedy, pneumatic-tired motor trucks, B. F. Patterson, paving contractor of Columbus, Ohio, performed the unusual feat of hauling sheet asphalt mix a distance of 42 miles and delivering it at a temperature hot enough to meet specifications for paving the main street of Richwood, Ohio, a town of 1,800 inhabitants in Union County. To retain the heat of each load of asphalt during the long trip between Columbus and Richwood, truck bodies were insulated with plank linings and were covered with heavy tarpaulins.

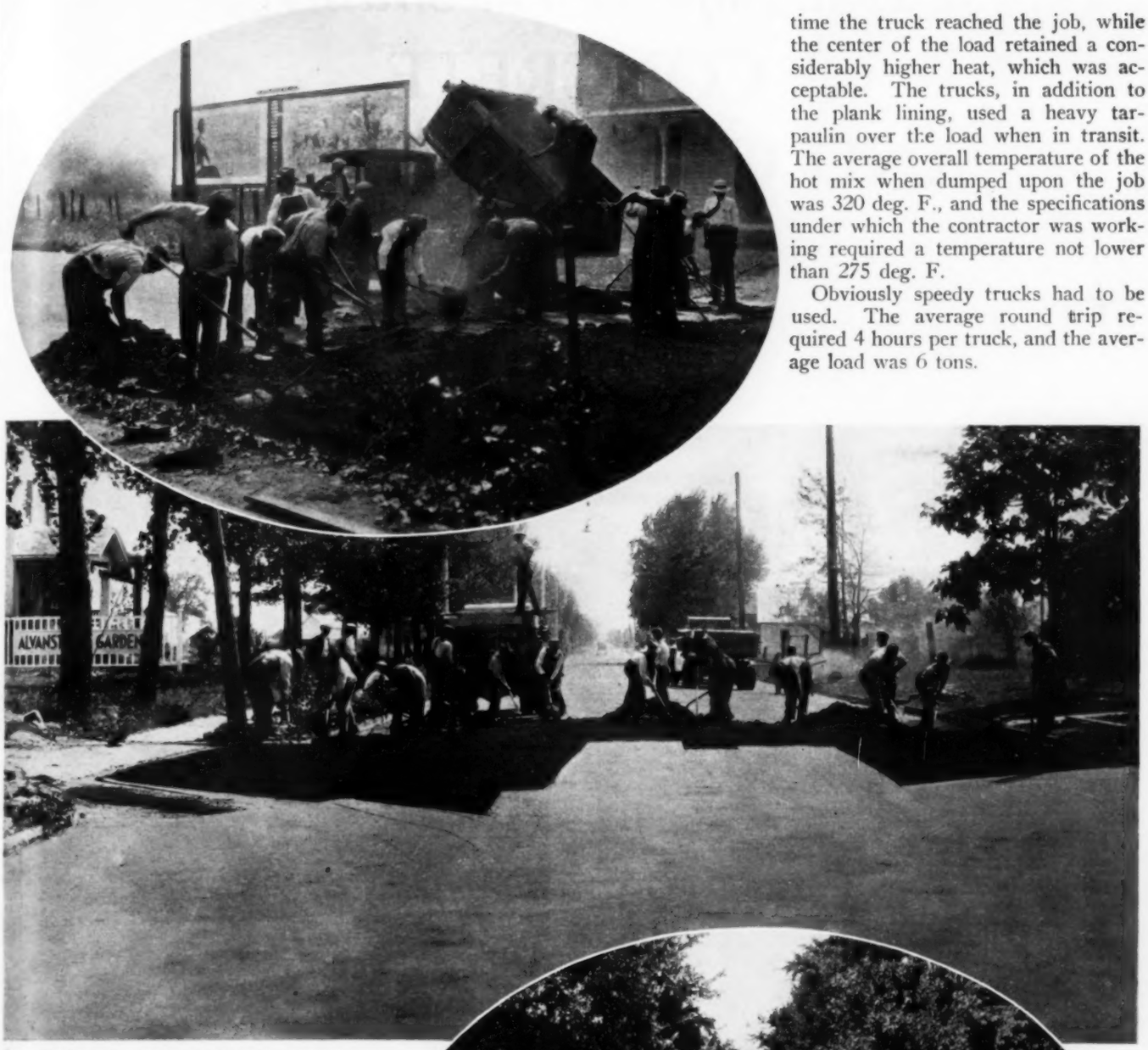
The contract, awarded July 29, called for resurfacing an old brick pavement with sheet asphalt, amounting to 23,869 sq.yd. of pavement and 500 tons of asphalt binder. The cost was $21,641. Oct. 15 was the date set for completion, but with favorable weather Mr. Patterson completed the job Sept. 10. The improvement is 5,045 ft. in length and 66 ft. wide in the business section of the town, tapering to 36 ft. through the north and south sections of Franklin St.

This case of long haulage indicates that under proper conditions sheet asphalt paving may be used in small towns where the size of the job has previously been considered too small to justify the expense of moving an asphalt plant to the community.

Asphalt in Ohio is used principally



FLEET OF 25 SPEEDY TRUCKS, with pneumatic tires and bodies insulated with plank linings, delivered 6-ton loads of asphalt, hot, after a haul of 42 miles from Columbus. ROLLING *(above)* was done with an 8-ton machine.



DUMPING AND RAKING the hot asphalt on Richwood's main street under the inspection of Prof. R. C. Sloane of Ohio State University *(in oval, above, at extreme right).*

for resurfacing old, worn-out pavements. It consists of a wearing course and a binder course, each at least 1½ in. thick. Specifications call for a temperature, on the job, of not less than 275 nor more than 350 deg. F.

On the Richwood paving work experiments indicated that only fast trucks having pneumatic tires could be used, and that the bed and sides of the truck had to be insulated with plank lining. Trucks with solid tires, it was found, segregated the aggregate, making the mix non-uniform. Without the insulation it was found that the temperature on the edges dropped below the required 275 deg. F. by the time the truck reached the job, while the center of the load retained a considerably higher heat, which was acceptable. The trucks, in addition to the plank lining, used a heavy tarpaulin over the load when in transit. The average overall temperature of the hot mix when dumped upon the job was 320 deg. F., and the specifications under which the contractor was working required a temperature not lower than 275 deg. F.

Obviously speedy trucks had to be used. The average round trip required 4 hours per truck, and the average load was 6 tons.

THE FINISHED JOB. Residential section of Franklin St. with new sheet asphalt surfacing over old brick pavement.

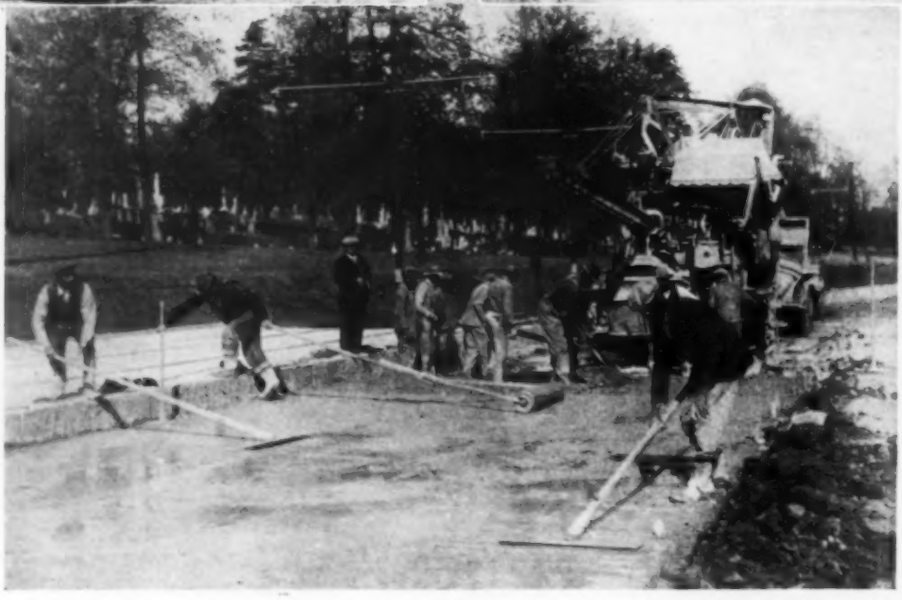
St. Louis Improves Two Streets With CONCRETE AND GRANITE BLOCK

READY-MIXED and dry-batch concrete entered into the construction of 37,000 sq.yd. of base for granite block on a widened and improved Broadway in the north part of St. Louis, and dry-batch concrete alone was supplied for 25,000 yd. of slab laid on Calvary Ave. and its new north and south connections with the reconstructed portion of Broadway. The complete program gives St. Louis a widened Broadway for 9,700 ft., with street car tracks removed from the roadway to the west side of the street for most of the distance, and an efficient connection between this important thoroughfare and boulevards to the west.

Broadway Work — The Broadway improvement, 9,700 ft. in length, consisted in removing the car tracks, widening the street and paving the new roadway except where the old pavement could be left intact. Prior to construction by the paving contractors, the St. Louis Public Service Co. relocated the car tracks to the west of the roadway on cemetery property obtained by the city. This relocation was possible only on the 5,069-ft. section of the Stiers Brothers' Construction Co. and on the 2,075-ft. section of the Perkinson Brothers' Construction Co.

TWO-MAN RAKE distributes dumped concrete over subgrade. Rakes are very generally used for this purpose in St. Louis.

READY - MIXED CONCRETE is supplied for base on two Broadway sections. Note car tracks relocated outside street.



CURBSTONE *(in circle, above)* is reset to new line on each side of Broadway. After setting, workmen tamp concrete beneath stone.

PAVING MIXER *(left)* produces base concrete on one Broadway contract. Long-handled, hollow, welded roller brings water to surface. Floats finish base.

RECUT GRANITE BLOCK laid on 1-in. bed of coarse screenings, paves 18,500 yd. on Broadway. Equal yardage of new block completes surface.

WHERE RESTRICTED SPACE *(below)* makes use of welded roller impossible, tampers work mortar to surface of base concrete.

FIRST STEP in construction of south Calvary connection is building of concrete gutter 2½ ft. wide and 8 in. thick.

METAL SCREED, with man aboard, shapes fresh concrete to curved contour of gutter.

These two contractors widened the street from 60 ft. to 80 ft. and filled in all the gaps in the paving caused by moving back both curb lines and by removing the tracks. On the 2,554-ft. section of the Chase Construction Co., it was impossible to relocate the tracks; but the Public Service Co. reconstructed them in advance of the contractor. The Chase Construction Co. widened the roadway from 36 ft. to 60 ft. All the contractors carried on their work in such a way as not to interrupt the flow of traffic.

The granite block wearing surface was placed on a 1-in. bedding course of screenings spread over an 8-in. concrete base. Where changes in grade necessitated slight lowering of the old base, the concrete was trimmed with pneumatic paving breakers to a depth which would give 3 to 4½ in. of new concrete on the old.

The Stiers Brothers' and Chase construction companies used ready-mixed concrete, and Perkinson Brothers employed a Koehring 21-E paving mixer. One of the contractors expressed the opinion that mixing on the job was cheaper but that ready-mixed concrete was cleaner and more convenient to use and was a better product, because of more uniform and accurate control of proportioning. The General Material Co. supplied the ready-mixed concrete.

Granite block removed in making street changes was recut and laid on about 18,500 sq.yd. New block covered an approximately equal area. Specifications required a block thickness of 4¾ to 5¼ in.

Calvary Ave. Improvement — The old Calvary Ave. descended to Broadway on the car track side at a grade of 14 per cent. To eliminate this dangerous grade, the Division of Streets and Sewers laid out a Y, with the north and south legs approaching Broadway on a 7 per cent maximum grade. The north leg has two 20-ft. roadways for one-way traffic; the south leg carries

ASPHALT MASTIC, containing approximately 50 per cent hot asphalt and 50 per cent fine chats, is mixed by revolving paddles in buggy and is spread over granite block to fill joints. Hot squeegee irons work mastic into joints. Pile of torpedo gravel in left foreground will be spread over surface.

CONCRETE SLAB on Calvary Avenue and north and south connections is laid by paving mixers. Skrainka Construction Co. uses rolling bridge and longitudinal float.

two-way traffic on a 30-ft. roadway.

The Skrainka Construction Co., contractor for the grading and paving of Calvary Ave., sublet 12,000 yd. of slab on old location to Alfred Lewald, Inc., and built the north and south connections itself with a Koehring 21-E paver, hauling batches from the limestone quarry of the Union Quarry Co., a subsidiary.

For the City of St. Louis, W. W. Horner, chief engineer, Division of Streets and Sewers, supervised the work. George C. Gundlach, engineer of street construction, was in general charge of operations, with F. A. Winter, district engineer, in direct control.

WILLIAM H. PERKINSON *(right)*, of Perkinson Brothers' Construction Co.

ALDEN CHASE *(left)* of Chase Construction Co.

A. W. BUMB *(left)* inspector, and **F. A. WINTER**, district engineer, Division of Streets and Sewers.

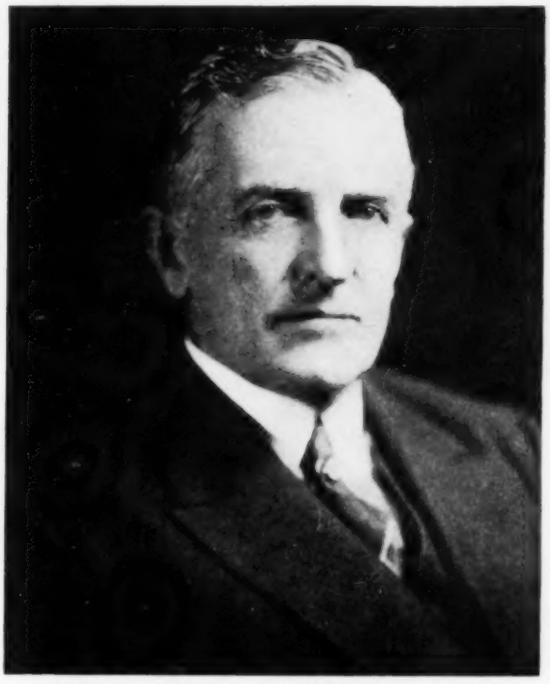
P. D. HUFFORD, paving superintendent, Stiers Brothers' Construction Co. In background is 800-gal. tank for storing asphalt and keeping it warm on the job.

LOUIS SKRAINKA *(left)*, of Skrainka Construction Co., and **GEORGE C. GUNDLACH**, engineer of street construction, Division of Streets and Sewers.

Present and Accounted For —

A Page of Personalities

FOR LONG SERVICE in the engineering department of the City of Rochester, N. Y., covering a continuous period of 39 years, John F. Skinner, sanitary engineer, Department of Public Works, has received from the American Society of Municipal Engineers the Greeley Veterans' Award medal.



ROAD BUILDERS' PRESIDENTIAL NOMINEE. William R. Smith, president of the Lane Construction Corporation of Meriden, Conn., well known highway contractor, has been nominated to head the American Road Builders' Association, which holds this year's annual convention in St. Louis, Jan. 12-16.

HEADS SAFETY GROUP. George Widua, of Woods Brothers Construction Co., Lincoln, Neb., has been reappointed general chairman of the Construction Section of the National Safety Council.

NEW CITY ENGINEER. George B. Sowers *(below)*, for eight years assistant city engineer, has been promoted to be commissioner and chief engineer of the Division of Engineering and Construction, Department of Public Service, Cleveland, Ohio. He succeeds Robert Hoffman recently named as consulting engineer to city manager, Daniel E. Morgan.

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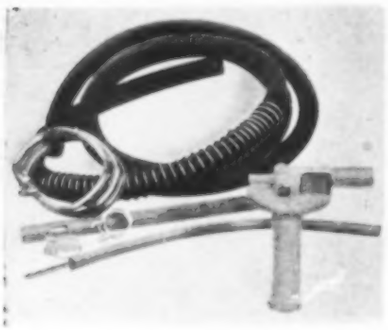
DIRECTS EQUIPMENT STUDY. M. DeGlopper, of the Michigan Highway Department, has been named by President W. A. Van Duzer as chairman of the Equipment Committee of the American Road Builders' Association.

LEADS MANUFACTURERS' DIVISION. William Ogden for many years connected with the Austin-Western Road Machinery Co. and with the Lakewood Engineering Co., and recently head of the manufacturers' group of the American Road Builders' Association, has been appointed manager of the Manufacturers' Division of the Affiliated Bureau of the Associated General Contractors of America.

NEW EQUIPMENT ON THE JOB

Mechanical Filler for Fuel Tanks

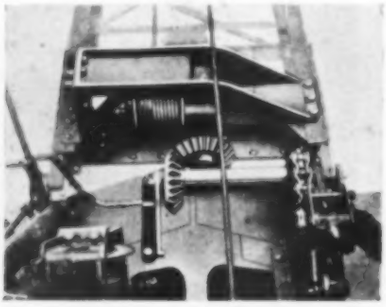
The No-Loss fuel tank filler, designed to fill tanks mechanically, without danger of loss or spilling, is offered by Motor Implements, Inc., of Newark,



N. J. The engine while idling on fuel from the auxiliary tank, creates a vacuum in the main tank by means of a permanent tube from the intake manifold, connected through a rubber hose to the filler head fitted into the opening on the main tank. This vacuum is sufficient to draw 10 gal. of fuel in about 1 min. through a 10-ft. hose connected to the filler head. Auxiliary tanks are furnished for tractors lacking them.

Two-Speed Hoist for Cranes

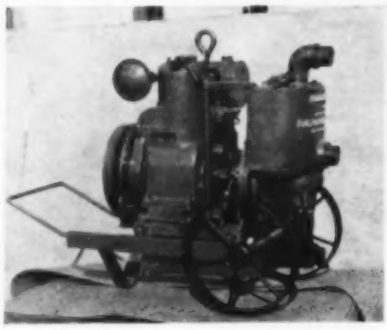
The Thew Shovel Co., Lorain, Ohio, announces a precision two-speed hoistline control for all models of Thew-



Lorain cranes. One end of the cable is fastened to the hoist drum as usual; the other end, instead of being deadended at the boom head, is carried back to a drum at the base of the boom. The crowding mechanism drives this drum in either direction through an oil-inclosed, self-locking worm drive and a set of cut miter gears. In operation, the hoist drum lifts the load to approximate position, and the precision hoist on the boom is used to raise or lower the load slowly to final position.

Self-Priming Centrifugal Pump

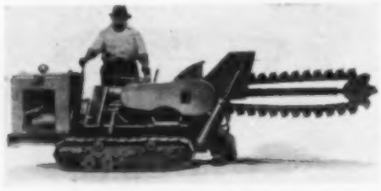
Ralph B. Carter Co., Hackensack, N. J., announces a 2-in. self-priming centrifugal pump which, it is claimed, pumps 6,000 gal. per hour under usual conditions. The pump is designed for contractors who do not need a large-size dewatering unit. It primes and reprimes itself automatically on all suc-



tion lifts up to 28 ft. Over-all dimensions are: length, 28 in.; width, 11 in., and height, 25 in. The unit is mounted either on a two-wheeled hand truck or on skids.

Diminutive Ditch Digger

The C. H. & E. Little Goldigger, produced by the National Equipment Corporation, Milwaukee, Wis., is a miniature ladder-type ditching machine, standing only waist-high and designed to cut trenches from 3 to 6 in. wide and up to 48 in. deep. Digging speeds



vary from 1 to 6 ft. per minute. Two speeds are available without changing sprockets and 36 may be obtained by changing sprockets. A four cylinder 12-hp. engine drives the machine. Control levers have been centralized at one side for the convenience of the operator.

One-Tool Compressor

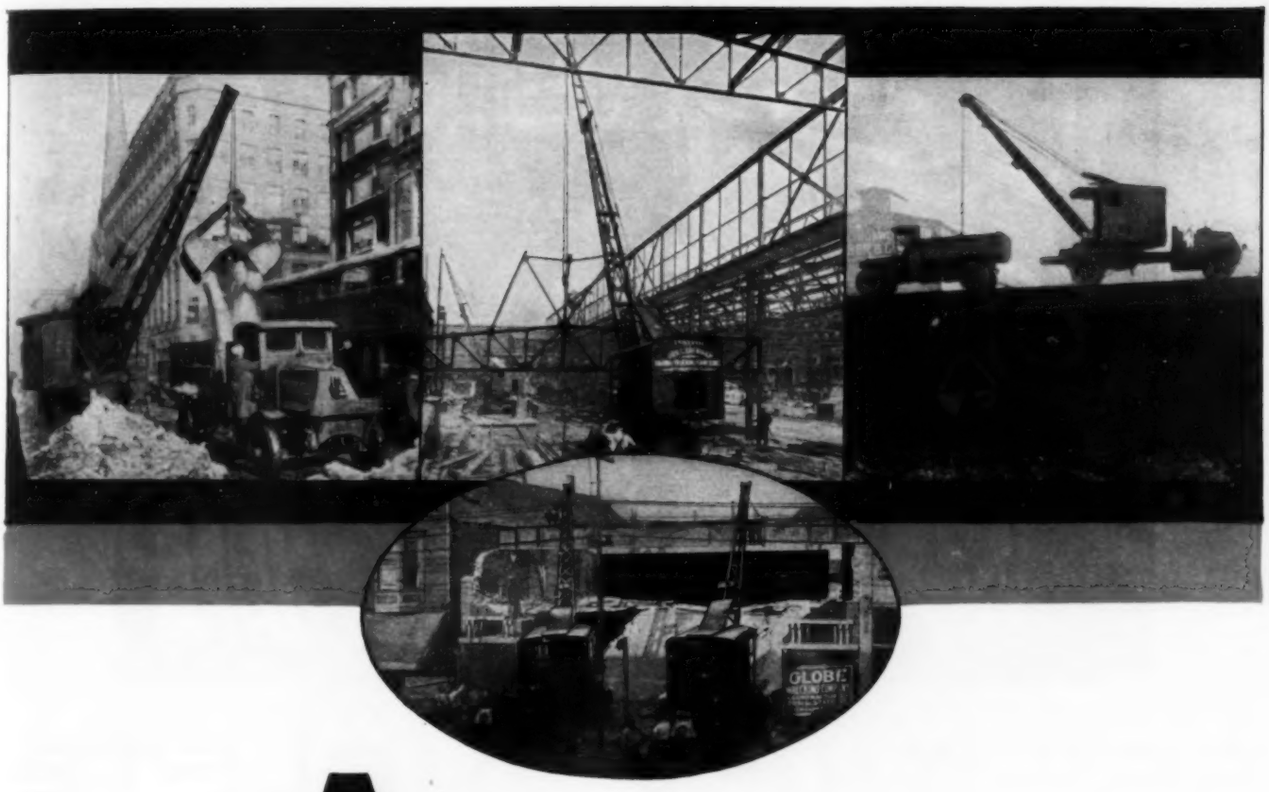
Schramm, Inc., of West Chester, Pa., has placed on the market Model 72 air compressor, a 72-cu.ft. machine for jobs where only a one-tool outfit is

needed. The new unit has the features included in the larger Schramm machines: a clutch that permits starting the engine independent of the compressor, an automatic cutout which slows down the speed of the engine when the compressor is unloaded, a heavy-duty Buda engine, and a heavy, hot-riveted tank.

Mechanical Spreader

The Little Giant HiSpeed stone spreader of the Giant Sales Corporation, Syracuse, N. Y., is described by the manufacturer as a mechanism of all-steel construction attachable to any make or type of truck with little effort. Approximately 15 min. is required to

attach or detach the apparatus, without drilling any holes or changing the truck construction. The link-chain drive from the truck to the spreader is manually controlled and can be disengaged by the operator regardless of truck speed. Spreaders are furnished in widths of 6, 7, or 8 ft., with a capacity range from 200 lb. to several tons per mile. The apparatus handles any size stone, cinders, or calcium chloride.



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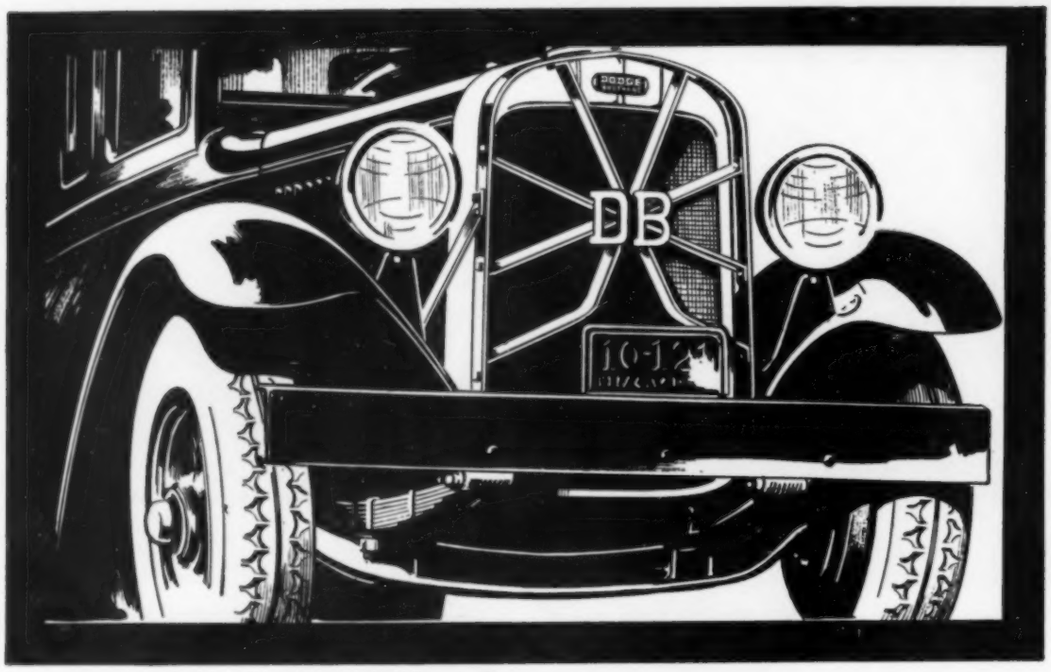

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SEE THEM AT THE ROAD SHOW—SPACES 13 AND 15

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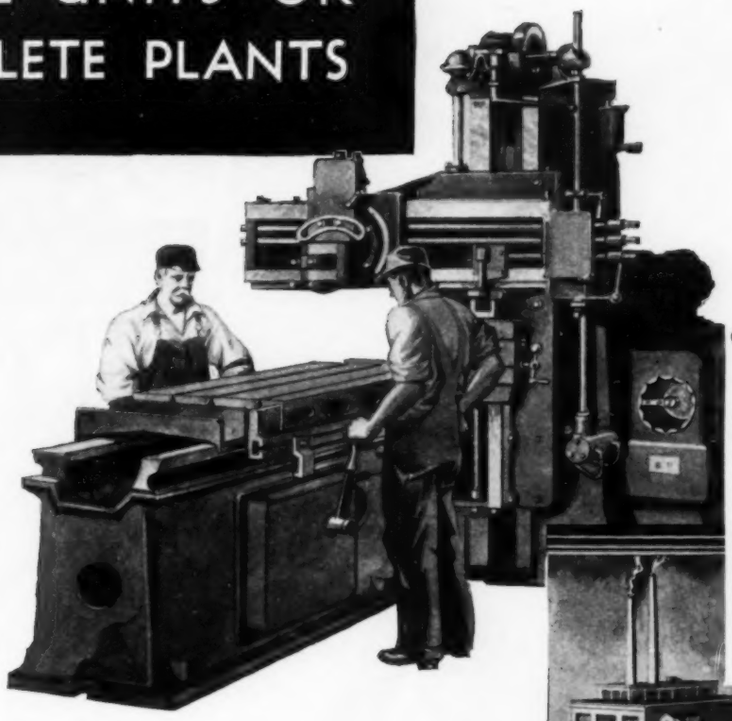

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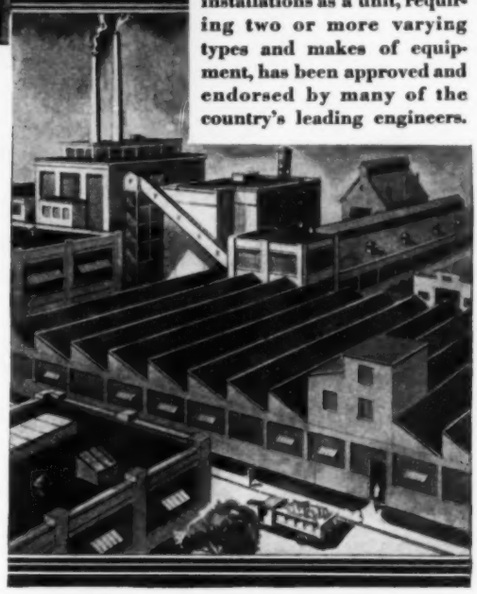

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Stands for Comfort And Long Life

Carpincho—that's the name of the leather from which the newest Sabin Glove, No. 259 is made.

It's a buffed pigskin from South America—soft but heavy and warm, comfortable as an old pair of shoes but literally has no wear out. There's nothing else like it.

It's the glove *you will want to wear* and which *you will want your men to wear* for inside or outside work, rain or shine. They will wash and when dried resume their original softness.

Look at the thumb—it's one piece. The glove is outseam throughout. Heavy full gauntlets protect the wrist. Yes, they have the famous Sabin holdtight back.

—But slip them on—work with them—and six months from now you'll still have them if you haven't lost them—or someone else taken a liking to them.

SABIN
GLOVES
. . . for construction work

Use the coupon

SABIN CO.—*Gloves*
Youngstown, Ohio

SABIN CO., Gloves
536-40 W. Federal St., Youngstown, Ohio

( ) **Enclosed find $1.60 for sample pair your No. 259 glove size** .....

( ) **Please quote us price on** ..... **doz. pair No. 259 glove sizes** .....

Name .....

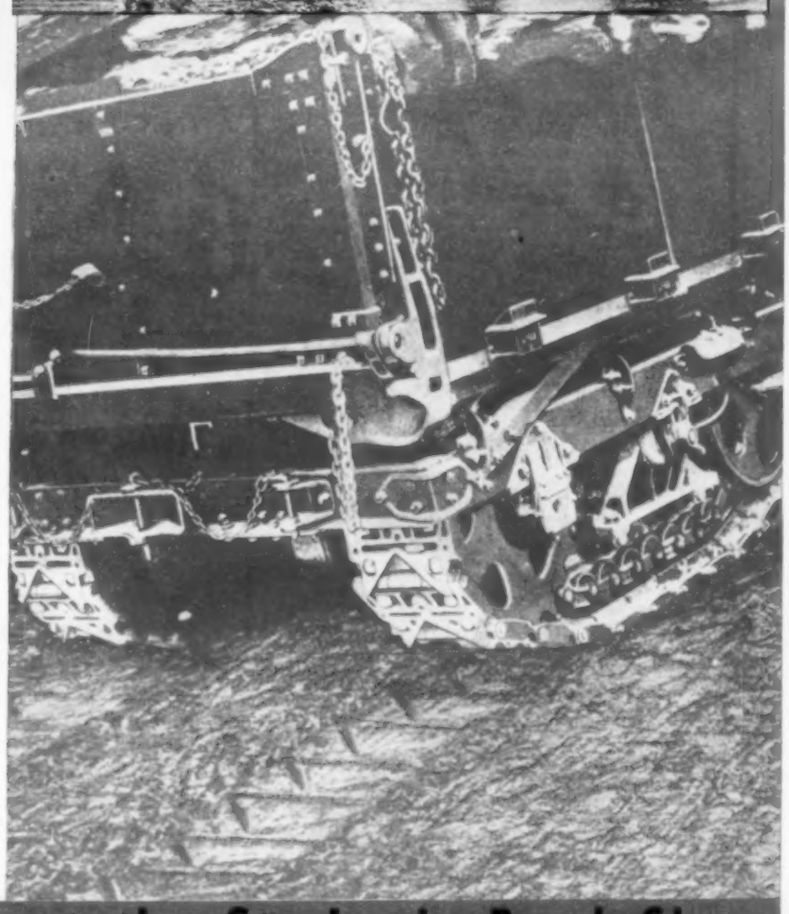
Address .....

.....

Please send us folder describing all your gloves for the construction man.

LINN goes where others fear to tread

MORE than a truck. More than a tractor. LINN is a super vehicle and carries a great pay load! Note the job pictured above. Three Linn Tractors out of a large fleet owned by Lane Construction Co. of Meriden, Conn. are shown at work relocating a river channel near North Adams, Mass. An ordinary vehicle would mire on this job. But not LINNS — they pull right through mud and water and sand, over rocks and broken ground. Four speeds ahead . . . four speeds in reverse . . . permit shuttle like operation between a power shovel and a soft fill without turning around. Speed and flexibility for low cost—records on every job. Write for certified performance and facts about the LINN.



Booth No. A-106 at the St. Louis Road Show

LINN MANUFACTURING CORPORATION

Division of LaFRANCE-REPUBLIC Corporation

Factory: Morris, New York

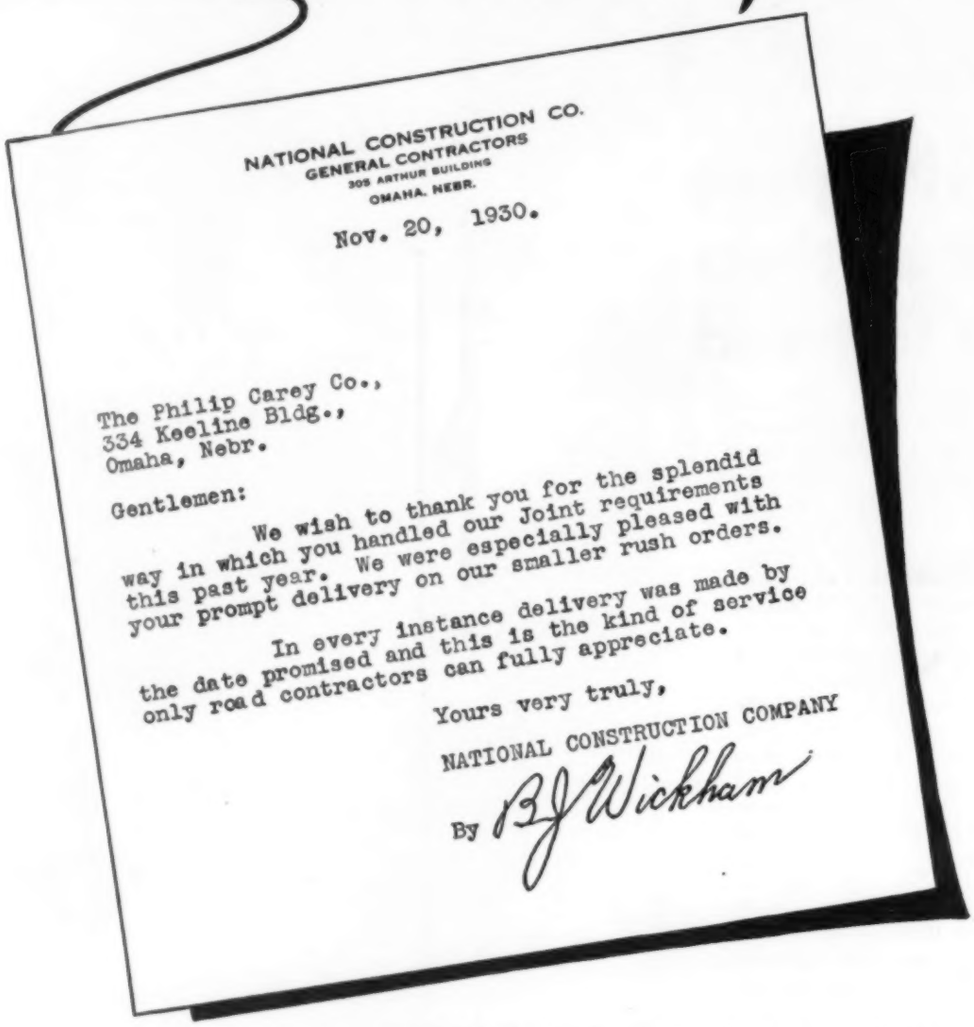
Represented in:

New York City
Skowhegan, Maine
New Haven, Conn.
Johnson City, Tenn.
Pittsburgh
Louisville, Ky.
Detroit
Chicago
St. Louis
Kansas City, Mo.
Little Rock, Ark.
Tulsa, Okla.
Omaha, Nebr.
Sioux Falls, S. D.
St. Paul, Minn.
Salt Lake City
Denver
Los Angeles
San Francisco
Portland, Ore.
Spokane
Forty Fort, Pa.

Canadian Linn Distributors: Mussens Limited, Montreal

LINN TRACTORS

Service—*the kind you want*



NATIONAL CONSTRUCTION CO.
GENERAL CONTRACTORS
305 ARTHUR BUILDING
OMAHA, NEBR.

Nov. 20, 1930.

The Philip Carey Co.,
334 Keeline Bldg.,
Omaha, Nebr.

Gentlemen:

We wish to thank you for the splendid way in which you handled our Joint requirements this past year. We were especially pleased with your prompt delivery on our smaller rush orders.

In every instance delivery was made by the date promised and this is the kind of service only road contractors can fully appreciate.

Yours very truly,

NATIONAL CONSTRUCTION COMPANY

By B J Wickham

See us at Booth A-80
at the Road Show

Other CAREY Products

ELASTITE BRIDGE FLOORING
BUILT-UP ROOFS
CAREYSTONE CORRUGATED
CAREYSTONE SHINGLES
HEAT INSULATION
ASBESTOS PRODUCTS
ROLL ROOFINGS
ASFALTSLATE SHINGLES
ROOF COATINGS
WATERPROOFING MATERIALS
ELASTITE RAIL FILLER

CAREY Elastite Expansion Joint is on the job when needed—and you know what that means on concrete paving. Stocks are carried in every important city in the country, and any size order can be delivered without delay.

CAREY Service keeps pace with the demand for Elastite Expansion Joint, which has proved its value in concrete paving for almost 20 years. Road builders who wish a proved product and insurance against costly delays, depend on CAREY Elastite. Write for current price list and trade discounts.

Carey Elastite EXPANSION JOINT

THE PHILIP CAREY COMPANY — Lockland, Cincinnati, Ohio

Portable Electric Tools

Speed Up the Job!

Use Them to Save Time and Labor

The World-Famous ½-Inch Electric Drill

Designed and built for hard, constant use, the Black & Decker ½-Inch Portable Electric Drill has long been the most widely used electric drill in the world.

Readily portable, weighing only 12½ pounds, yet so powerful that a man cannot stall it—even when drilling in steel at its maximum capacity. Universal Motor. Other drills in sizes from ¼-inch to 1½-inch, with hole saws and other accessories available to extend their usefulness.

Portable Electric Saws do the Work of Six Men

These safe, easily-handled saws will rip six times as fast as hand sawing and crosscut seven times as fast. Ideal for all types of building work, large construction jobs, repair work, etc.

Table adjustable from 0° to 45° for bevel cutting and other special sawing operations. With proper blade will also cut light metal, slate, marble, asbestos, tile, transite and porcelain. Universal Motor. Built in 6-inch, 8-inch and 10-inch sizes, packed in convenient carrying cases.

Drive Screws with Portable Electric Screw Drivers

Powerful Ball-Bearing Electric Tools for driving screws and nuts. Similar in construction to Black & Decker Electric Drills, except that spindle is provided with a positive clutch which releases screw when forward pressure on tool is relieved.

Ideal for driving any wood screws up to No. 16 by 3¼-inch long in hardwood, lag screws up to ⅜-inch by 4-inch long and nuts or bolts up to ¾-inch diameter. Universal Motors. Made in two convenient sizes.

The BLACK & DECKER 1⅛-INCH ELECTRIC HAMMER Quickly Pays for Itself!

IT STRIKES 2900 hard blows per minute continuously . . . and a man can strike only about 50 . . . **think of the difference!**

That's why this amazingly efficient electric hammer is indispensable for any "hammer-action" job such as driving star drills, steel chisels and wood-working chisels. Drills 1-inch holes in concrete at rate of 3 inches per minute—in brick, 8 inches per minute! Ideal for heavy mortising, bushing, caulking, demolition work, corner chiseling, etc.

Fitted with powerful Universal Motor, operating on A. C. or D. C. and Self-Cooling Barrel. Packed in Fibre Carrying Case. Available in ⅝-inch, 1⅛-inch and 1½-inch capacity sizes.

See them at your Distributor's today.

• • Your Jobber Has Them • •

Mail This Coupon for Catalogue

BLACK & DECKER

TOWSON, MARYLAND, U. S. A.

Slough, Bucks., England — **Toronto, Ontario, Canada** — **Sydney, Australia**

The BLACK & DECKER MFG. CO. CON
TOWSON, MARYLAND, U. S. A.

Please send me catalogue showing full line of Electric Tools. I am particularly interested in:

Electric Hammers — Electric Drills
Electric Saws — Electric Screwdrivers

Name.....

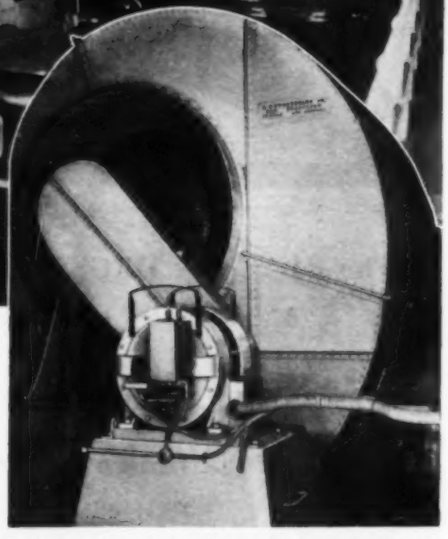
Address.....

Distributor's Name.....

TRADITION

"WHAT'S all this hullabaloo you're raising about motors? The motors we've always bought are as good as any."

Thousands of motorists drive through the George A. Posey Tube daily without danger of asphyxiation due to the efficient operation of the 16 Lincoln "Linc-Weld" motors which drive the ventilating fans. At left is shown the Alameda entrance to the tube. Below is an interior view of the tube.



The huge intake and exhaust fans which change the air inside the entire tube 40 times per hour are powered by 75-h.p. four-speed Lincoln "Linc-Weld" motors. A typical installation view is shown above.

PROGRESS

"Says you, Pop, because you've always bought motors mostly by guess.

The engineers on the George A. Posey Underwater Vehicular Tube (between Oakland and Alameda, Calif.) bought the motors which proved best by test . . . Lincoln 'Linc-Welds'.

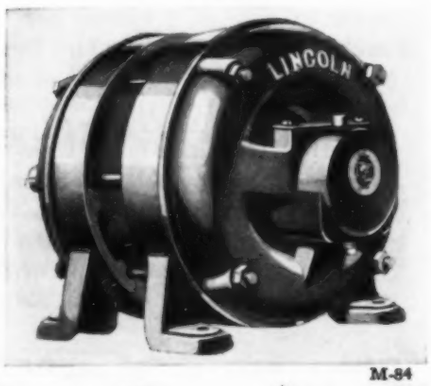
When you consider, Pop, that lives of the motorists while they pass through the tube are dependent on the operation of these motors you can realize the severity of the tests which Lincoln 'Linc-Weld' motors withstood as a guarantee of their future performance.

Since the tube was opened over two years ago, sixteen 75-h. p. four-speed Lincoln 'Linc-Weld' motors have driven the huge ventilating fans without interruption from motor trouble.

It pays, Pop, to examine the label, also the motor before you buy.

THE LINCOLN ELECTRIC COMPANY

Department No. 32-1 Cleveland, Ohio



M-84

LINCOLN

"LINC-WELD" MOTORS

Write For Catalogs

KNOW these N.E.C. road building units — what N.E.C. standards of engineering, construction and service mean to greater road building profits.

KOEHRING AUTOCYCLE PAVER — accurately timed automatic actions from raising of skip to discharge of "dominant strength" concrete! The fast *Heavy Duty* paving unit!

KOEHRING SHOVELS — capacities rated on line-of-plate "struck" measure — the "heap" is extra pay dirt! Crowds above and beyond end of boom! Full power behind either hoist or crowd. Cuts down "nibbling." The *Heavy Duty* Shovel.

HALF-YARD INSLEY SHOVEL — fast, right or left steering, fast-swinging half-yard excavator, not the lowest in price but the outstanding value in its class.

SMITH PAVER — fast placement of concrete on the subgrade. Strong dependable construction — a great value.

C.H.&E. ROAD PUMP — 80 gallons per minute up to 5 miles; 70 gallons per minute up to 7 miles.

N.E.C. service everywhere. Make sure of greatest possible profits by using N.E.C. equipment. *Write for catalogs.*

National Equipment Corporation

A 6162-I-C

Milwaukee

Replacing rigid type drain with GOHI Corrugated Culverts, on Dixie Highway, north of Falmouth, Ky.

"GOHI" *Defeats* the Ravages of Time . . .

GENUINE OPEN HEARTH IRON
GOHI
TRADE MARK
PURE IRON - COPPER ALLOY
REG. U.S. PAT. OFF.

(Meet copper-bearing pure iron requirements in all accepted specifications for corrugated metal culverts.)

Corrugated Culverts

HERE is a graphic story of Progress — a modern GOHI Corrugated Culvert replacing a culvert of non-flexible material that did not withstand the ravages of abrasion, freezing, settling earth, and the ceaseless vibration of traffic.

This represents what today is happening on the highways of the nation, where drainage efficiency on a low-cost-per-year basis is demanded.

Time has fully demonstrated that GOHI Culverts cost less per year of service. Reasonably low first cost; low-cost handling and installation; freedom from breakage; long life of material, due to inherent resistance to corrosion; — all these factors contribute to GOHI Culvert economy.

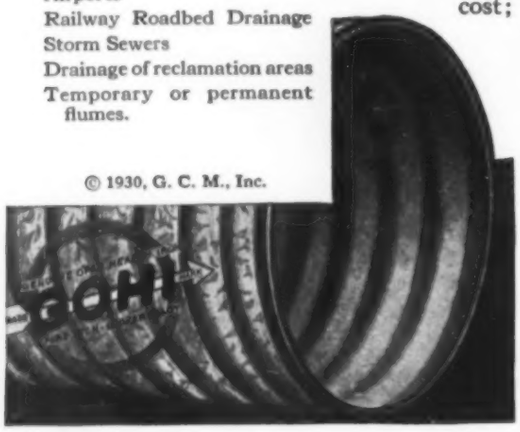
GOHI Culverts are made of Genuine Open Hearth Iron — pure iron-copper alloy — which lasts longer because of the purity of the base metal combined with pure ingot copper.

Searching comparison of costs and duration of service will convince you of the superiority of GOHI Culverts from the investment point of view.

Use GOHI Culverts for

- Reservoir Syphons and Outlets
- Highways
- Real Estate Developments
- Golf Courses
- Airports
- Railway Roadbed Drainage
- Storm Sewers
- Drainage of reclamation areas
- Temporary or permanent flumes.

© 1930, G. C. M., Inc.



GOHI CULVERT MANUFACTURERS, Inc., Newport, Ky.

Lincoln Steel and Forge Co.
St. Louis, Mo.

The Newport Culvert Co.
Newport, Ky.

The Pennsylvania Culvert Co.
Philadelphia, Pa.

Denver Steel & Iron Works Co.
Denver, Colo.

A. N. Eaton, Metal Products
Omaha, Nebr.

Feenaughty Machinery Co.
Portland, Oregon

Tennison Brothers
Texarkana, Ark.

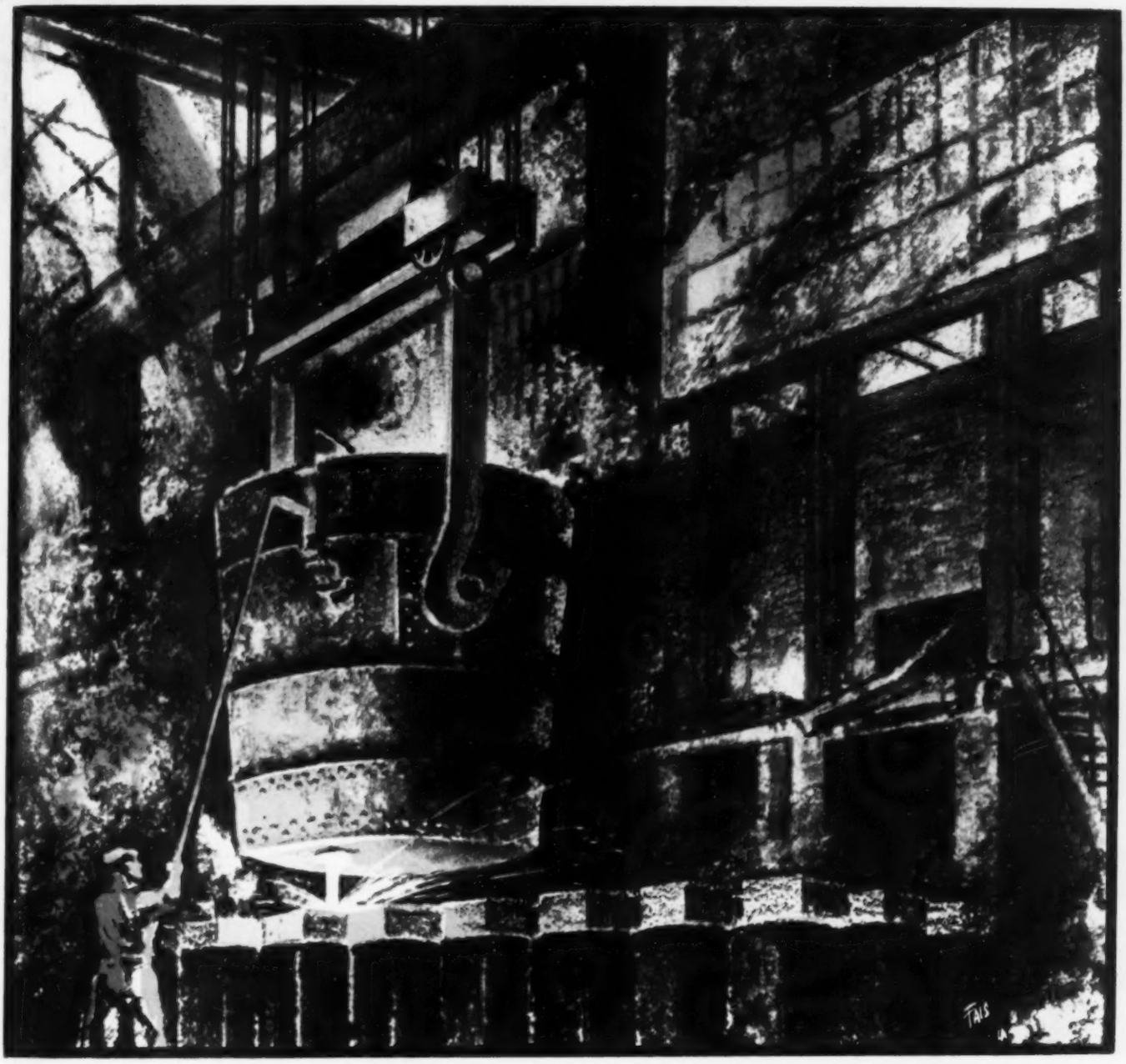
Capital City Culvert Co.
Madison, Wis.

Central Culvert Co.
Ottumwa, Iowa

Roanoke Sales Corp.
Roanoke, Va.

St. Paul Corrugating Co.
St. Paul, Minn.

Tennison Brothers
Oklahoma City, Okla.



Pouring a heat of acid steel

for Roebling Wire Rope

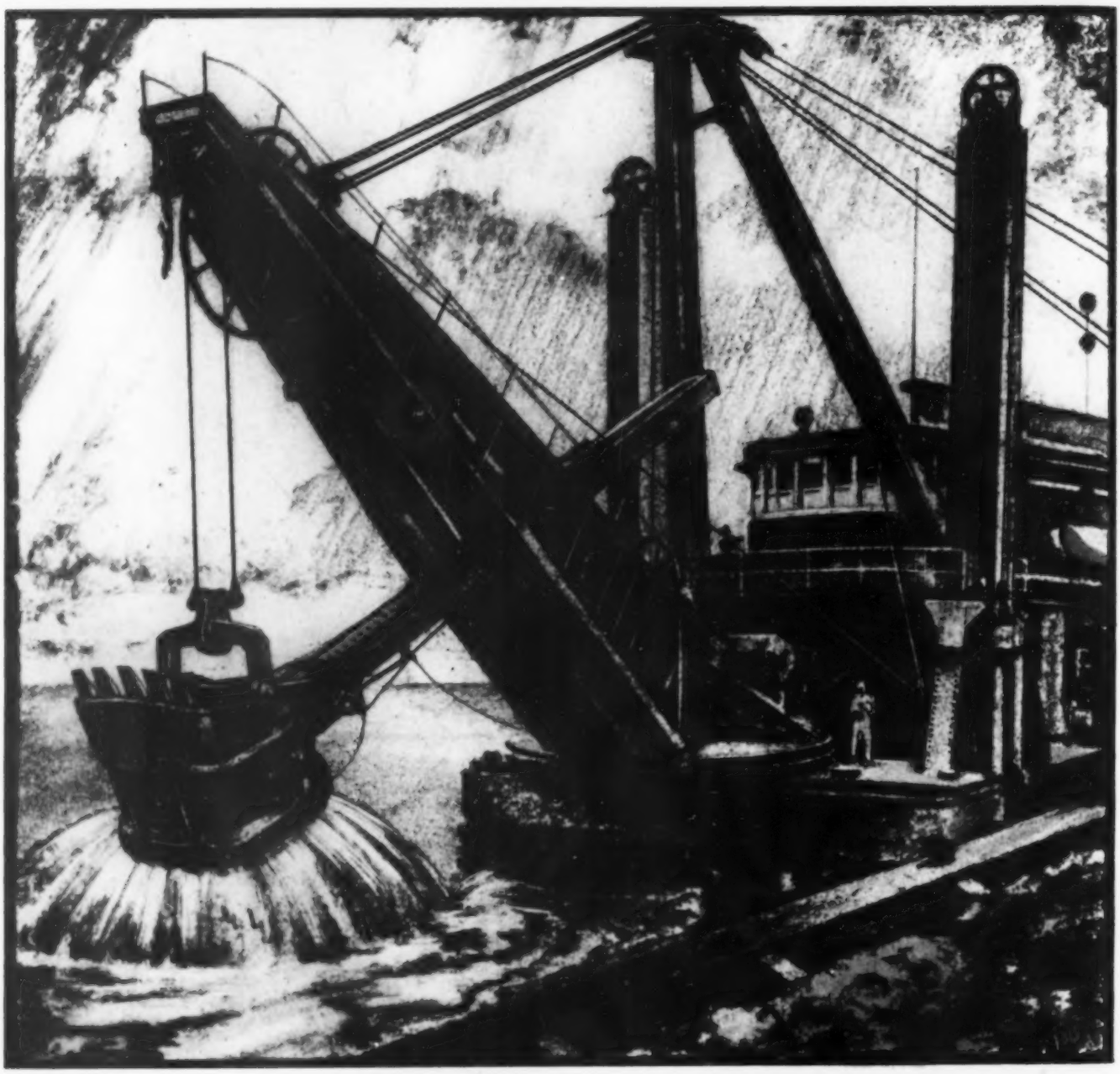
THE MOLTEN METAL has been tapped into a huge ladle. And now it is being poured into the molds. Soon, in the form of ingots, it will be on its way through a seemingly endless number of processes. Finally it will be shipped out as Roebling "Blue Center" Steel Wire Rope.

Roebling Quality starts with the making of the steel and is under Roebling control every step of the way. It is the result of highly developed, modern production methods plus close attention to detail.

Throughout the 48 states of the union, millions of feet of Roebling "Blue Center" Steel Wire Rope are daily demonstrating the safety and economy assured by Roebling Quality in every type of service.

ROEBLING **WIRE ROPE**

"BLUE CENTER" STEEL



A maximum bale pull of 350,000 lbs.
on the twin hoist ropes!

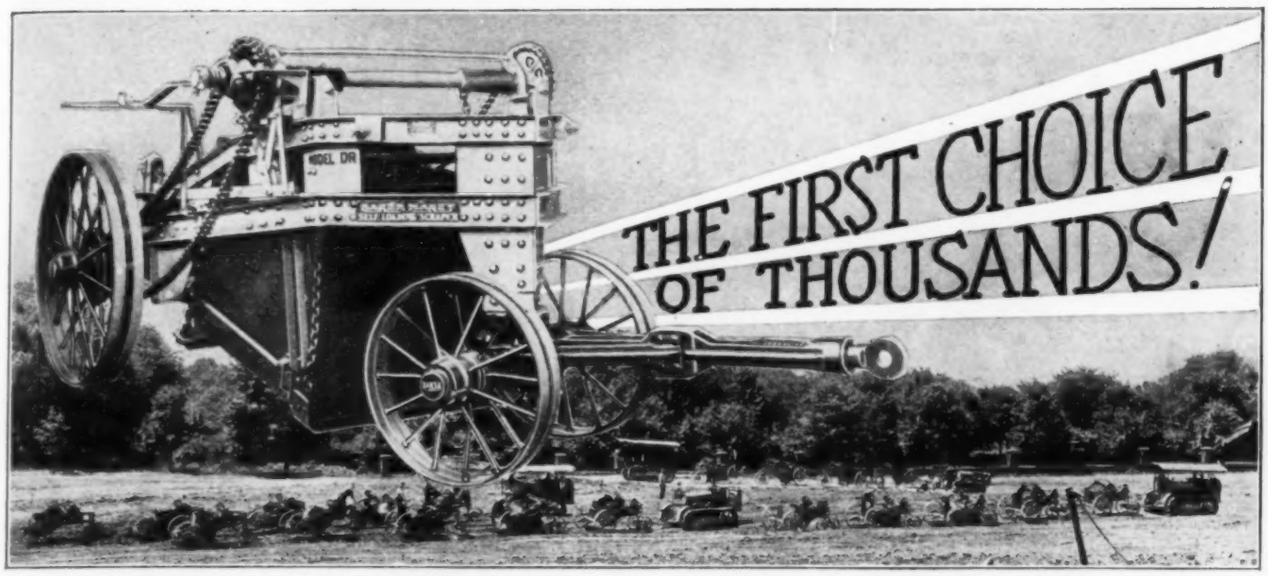
THIS electric dipper dredge, *The Crest,* is the most powerful of its kind and one of the world's largest. It is owned by the Great Lakes Dredge and Dock Co.

A giant in size and capacity, *The Crest* is powered by two 600 H. P. Diesel Motors, which exert a maximum bale pull of 350,000 pounds on the twin hoist ropes. It digs to a depth of 52 feet and its 16 cubic yard bucket is capable of digging in unblasted, solid rock.

You would expect the makers of this dredge to equip it with the finest and most dependable wire rope obtainable. It was rigged throughout with Roebling "Blue Center" Steel Wire Rope, 6000 feet in all.

JOHN A. ROEBLING'S SONS COMPANY
WIRE...WIRE ROPE...WELDING WIRE...FLAT WIRE
COPPER *and* INSULATED WIRES AND CABLES
TRENTON, N. J. *Branches in Principal Cities*

ROEBLING "BLUE CENTER" STEEL **WIRE ROPE**



BAKER MANEY
Self Loading Scrapers

"The Original Self Loaders"

1½ cu. yd.—1 cu. yd.—¾ cu. yd.

Only with a 4-wheel scraper can you get stability—thorough compacting action and extremely short turning radius.

20 **Baker Maneys owned by Fatout Const. Company, Indianapolis, on 200,000 cu. yd. grading job—constructing addition to Crown Hill Cemetery, Indianapolis.**

Thousands of contractors and road officials have expressed preference for Baker Maneys because of these outstanding features—big capacity—easy, quick operation—extremely short turning radius—low center of gravity—accurate cutting—rugged construction—low operation and maintenance costs. What more could you ask of a dirt moving machine?

When earth movers tell us (and prove it) that Baker Maneys have saved their price in a single short season—when they say they would rather be without any piece of their equipment than be without Baker Maneys—when they continually add Baker Maneys to their equipment year after year—they are proving the statement that "it pays to make 'em good."

Now Timken Bearing Equipped

Model DR, 1½ cu. yd. and Model KR, 1 cu. yd. Baker Maneys are now regularly equipped with Timken Tapered Roller Bearings giving them greater operating efficiency and longer life.

See the BAKER EXHIBIT at

1931 ROAD SHOW

ST. LOUIS, MO.

Jan. 10th to 16th

Or clip the coupon below and receive catalogues on Baker Tractor Equipment.

The BAKER MANUFACTURING CO.

568 Stanford Ave., Springfield, Ill.

BAKER TRACTOR EQUIPMENT
EARTH MOVING-ROAD MAINTENANCE-SNOW REMOVAL

Products You Should Know—

BAKER BULLDOZER

BAKER BULLDOZERS AND BACKFILLERS

Baker Hydraulic Bulldozers and Backfillers are built along new lines—high lift—work well below the track—full floating action independent of tractor motion. Built for Monarch and Caterpillar Tractors. Hand operated models for small tractors.

BAKER ROTARY SCRAPER

BAKER ONE-MAN ROTARY SCRAPERS

Built for any tractor in four models (13 to 40 cu.ft.) Automatic draft control — no backing up to dump—large deep bowls—greater capacity for their width than similar scrapers. Unbreakable steel tongue.

BAKER ROAD MAINTAINER

BAKER AUTOMATIC ROAD MAINTAINERS

Baker Multiple Blade Maintainers are built in 9 ft. and 12 ft. widths either with rubber tired or steel wheels. Scarifier attachment furnished when ordered. Trigger-speed adjustment of blade height unequalled on any other maintainer.

Send literature and prices on Baker Equipment.

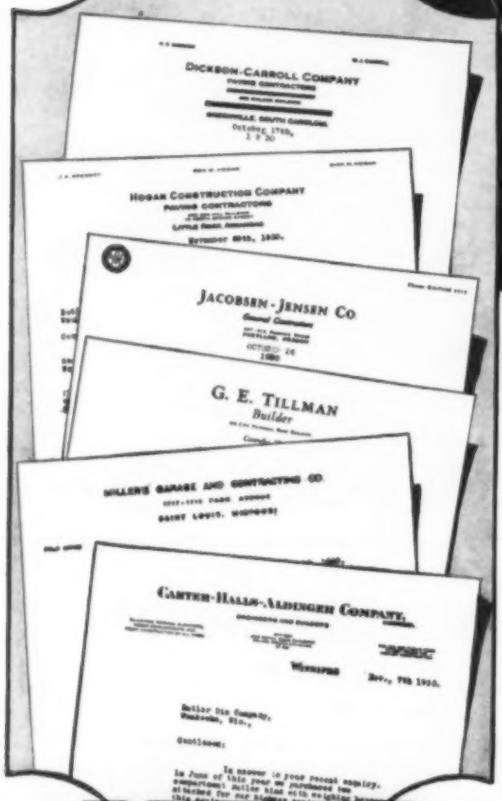
Name.....

Address.....

568

- BAKER MANEY SCRAPERS ☐
- ROTARY SCRAPERS ☐
- BULLDOZERS ☐
- BACKFILLERS ☐
- MAINTAINERS ☐
- SNOW PLOWS ☐

. . . ask the OPERATOR —about Butler Equipment



BUTLER
Steel **BINS**
and **HOPPERS**

HE will tell you that it's a snap to handle aggregates with Butler Bins and Weighing Hoppers. Owners, too, are enthusiastic about Butler equipment. Read what a few of them have to say in the following excerpts from letters shown on this page:—

". . . Butler Bin and Weighing Hopper—very satisfactory—do not see how contractor could be without them—easily weigh out two batches per minute."

". . . to use equipment for months with no upkeep or maintenance is a new and interesting experience. With a single operator we weigh two batches per minute — more than twice the speed required."

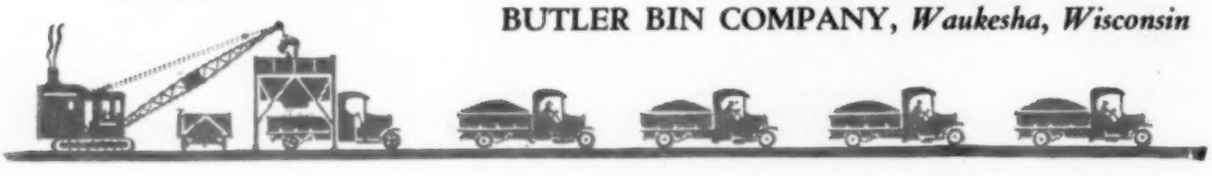
". . . bin worked perfectly; not only enabled us to produce concrete cheaper, but to mix much larger quantities."

". . . entirely satisfied. If we were in the market for another outfit, we would buy a Butler."

". . . we are not subjected to shutdowns on account of scales varying, as they stay in perfect balance."

If the experience of these satisfied users interests you, we will be glad to tell you more about it at the Road Show—*Booth AR-16.*

BUTLER BIN COMPANY, *Waukesha, Wisconsin*



Send for a sample of LAY-SET Preformed Wire Rope

Here is an actual photograph of ten short lengths of Lay-Set Preformed Wire Rope. Send for one of them. You will find it interesting to remove one of the strands from the rope—then one of the wires from the strand—and see for yourself how each is preformed.

Ordinary, non-preformed wire rope must be tightly seized before cutting, or the wires and strands will unravel. That is because of the locked-up internal stress in ordinary wire rope. In Lay-Set, each wire and strand is preformed—lies naturally in place—may be cut and handled without seizing. The preforming eliminates all internal stress or strain. That is why Lay-Set gives from 30% to 300% increased service and is easier and safer to handle.

Send for sample of Lay-Set Preformed Wire Rope and prove to yourself the merit of the preformed principle. The coupon below will bring you a free sample by return mail,—without obligation.

Hazard Wire Rope for Every Service

HAZARD ARMORED WIRE ROPE (GORE PATENT)—for use on operations where the service is particularly severe—HAZARD OLYMPIC GREEN STRAND—for use on all hoisting operations requiring maximum toughness and long wearing qualities. Hazard Bear Cat Rope—Marline Covered Wire Rope—Improved Flattened Strand Wire Rope—Slope Ropes, etc., etc.

HAZARD WIRE ROPE COMPANY
WILKES-BARRE PENNSYLVANIA

New York Pittsburgh Chicago Denver
Los Angeles San Francisco Fort Worth
Birmingham Philadelphia Tacoma

HAZARD WIRE ROPE CO.
Wilkes-Barre, Pa.

Send me a sample of Lay-Set Preformed Wire Rope—providing it places me under no obligation.

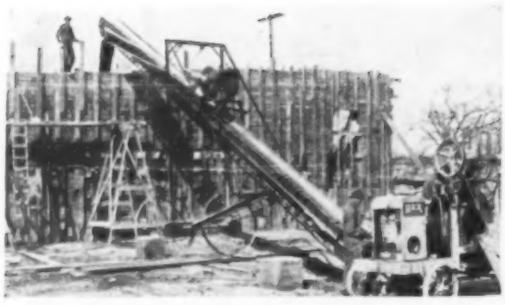
Name.....

Company.....

Address of Company.....

City..... *State*.....

NORTHERN KINGS ARE VERSATILE!



A 60-ft. Northern King placing mixed concrete for walls.

A 75-ft. Northern King places mixed concrete in hopper.

Gulfport, Miss. Sea-wall with Northern King conveying concrete to forms.

Placing concrete on part of Chicago Drainage Canal; 60-ft. Northern King in use.

ANY job can be finished faster and more economically if you use Northern Conveyors . . . for materials handling . . . for transporting materials from one point to another on the job . . . on a level plane, to an elevation or decline.

Northern King Conveyors are made to stand the gaff. They are available as stationary equipment or in hand-portable or full power propelled models . . . in any practical length . . . *complete,* and ready to take over every one of your materials handling problems.

Hundreds of Northern Kings in the field testify to their acceptance by construction engineers and contractors . . . under every conceivable condition, in all climates and on all types of projects.

Write!

Let us send you data and literature on the Northern King series . . . the finest belt conveyors money can buy! . . . made by specialists whose products are nationally known, nationally used and nationally distributed. Write now!

NORTHERN CONVEYOR & MFG. CO.
DEPT. 20 JANESVILLE, WIS.

OFFICES

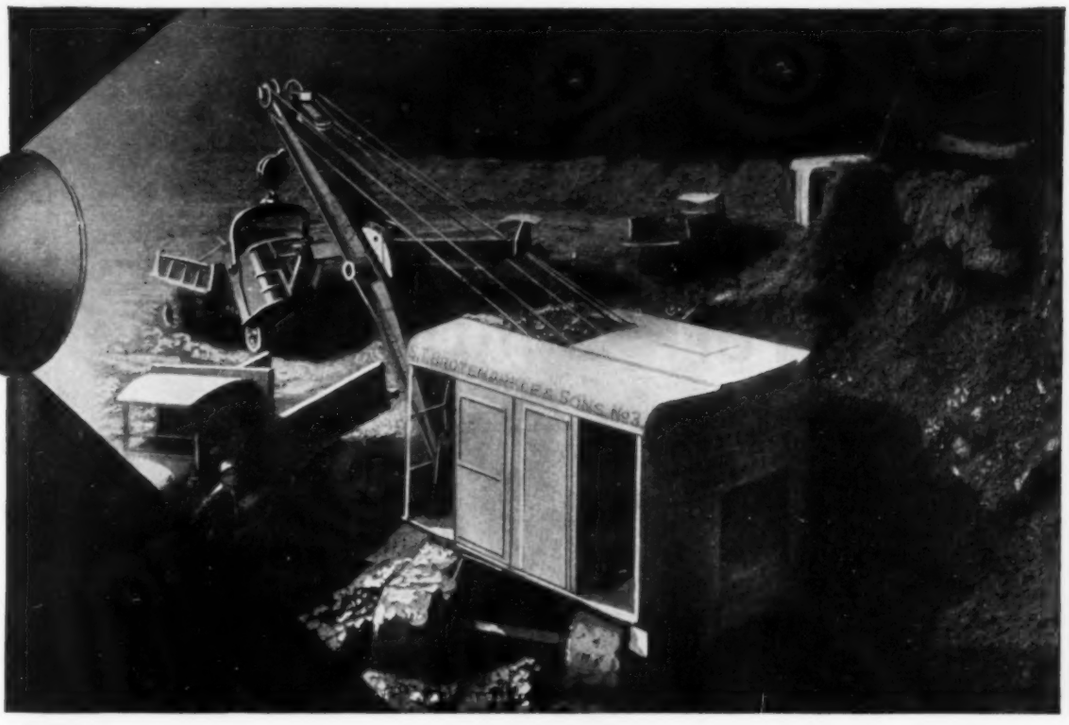
13712 Tyler St., Detroit, Mich. 614 Charleston Bank Bldg., Charleston, W. Va. 528 Oliver Bldg., Pittsburgh, Pa. McCormick Bldg., 332 S. Michigan Ave., Chicago, Ill. 2375 University Ave., St. Paul, Minn. Union Bldg., 1836 Euclid Ave., Cleveland, Ohio.

NORTHERN BUILT BETTER SERVICED BEST MATERIAL HANDLING EQUIPMENT

BRANCHES and STOCK

SAN FRANCISCO, CALIF.
NEW HAVEN, CONN.
ROCHESTER, N. Y.

WHEN EVERY HOUR COUNTS



WHEN your work falls behind schedule, and every hour counts—put Carbic Flood Lights on the job. Their powerful, clear, and diffused light rays enable your men to work after dark as rapidly and safely as by day. They are insurance against penalties.

Carbic Flood Lights are portable. Any workman can operate them. They last indefinitely. Initial cost is low, and the operating expense is negligible. Your name and address sent in on the coupon below will bring you complete information about every model.

THE LINDE AIR PRODUCTS COMPANY
Unit of Union Carbide and Carbon Corporation

UCC

General Offices · Carbide and Carbon Building, New York

District Offices—Atlanta · Baltimore · Birmingham · Boston · Buffalo · Chicago · Cincinnati · Cleveland · Denver · Detroit · El Paso · Houston · Kansas City · Los Angeles · Memphis · Milwaukee · Minneapolis · New Orleans · New York · Philadelphia · Pittsburgh · St. Louis · Salt Lake City · San Francisco · Seattle · Tulsa

Carbic is distributed by the Union Carbide Sales Company through its national chain of warehouses and is sold by jobbers everywhere.

CARBIC
PROCESSED CARBIDE FOR CARBIC LIGHTS & GENERATORS

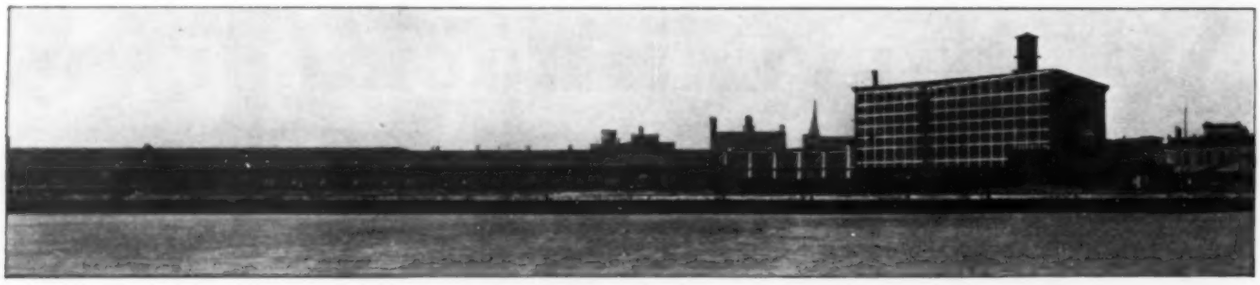
Technical Publicity Dept., , 205 East 42nd Street, New York, N. Y. C.M.-1-31 12th floor

Without obligation, I would like to have additional information on Carbic Lights.

Name..... *Street Address*.....

Company..... *Position*.....

City..... *State*.....



Lackawanna Deep-Arch Piling in New York Central Railroad Dock Toledo, Ohio

Walsh Construction Co., Davenport, Iowa, Contractors

Lackawanna Deep-Arch Piling Section DP 166 was used in constructing the 1440-foot dock shown above. The design is of the familiar type, consisting of a wall of Lackawanna Steel Sheet Piling tied to a timber anchorage by means of steel tie-rods. The depth of water at the face of the dock was increased by dredging to 22 feet below mean-lake level; the top of the dock is eight feet above the water level.

Due to its great transverse strength, Lackawanna Deep-Arch Piling is especially well suited for structures of this type. It has the high beam-strength necessary to carry the thrust of the fill on the long span between the tie-rods and the dredged bottom. Its extremely strong interlocks do not pull apart during driving, and provide a tight wall through which the fill cannot pass. Further, the use of Lackawanna Deep-Arch Piling permits a structure of simpler design, with resultant economy in materials and construction costs as compared with docks of other types.

There is a Lackawanna Piling Section—Deep-Arch, Arch-Web or Straight-Web—for every purpose. Write the nearest Bethlehem District Office for literature describing the complete line of Lackawanna Piling Sections. Our Engineering Department will gladly cooperate with you and suggest the section most suitable for your particular need.

BETHLEHEM STEEL COMPANY

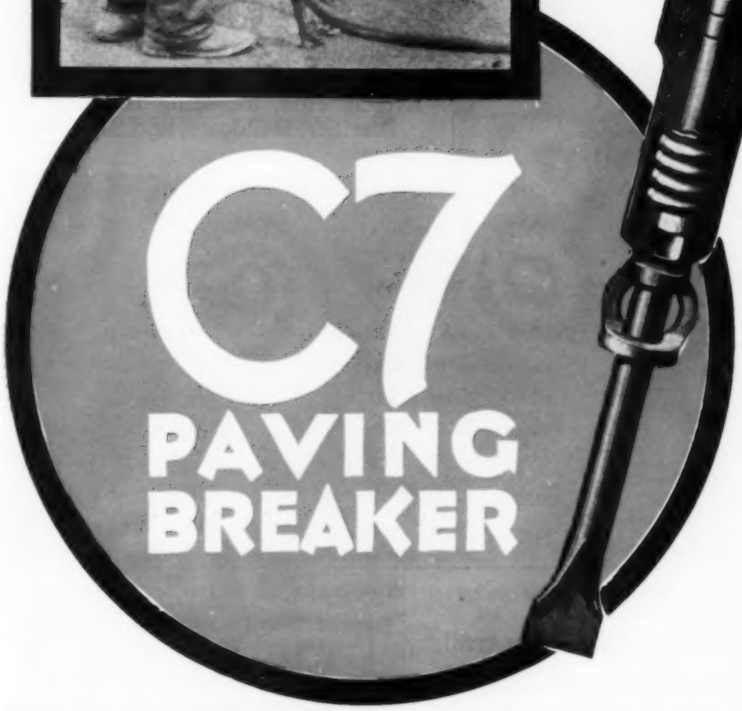
General Offices: Bethlehem, Pa.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Buffalo, Pittsburgh, Cleveland, Cincinnati, Detroit, Chicago, St. Louis.

Pacific Coast Distributor: Pacific Coast Steel Corporation, San Francisco, Los Angeles, Seattle, Portland, Honolulu.

Export Distributor: Bethlehem Steel Export Corporation, 25 Broadway, New York City.

BETHLEHEM



NEW POWER FOR NEW SAVINGS !

Power is what you want—and the C7 Paving Breaker has it.

It packs a real wallop—breaks reinforced concrete into big, time-saving chunks—and does it with a *new minimum* of air and effort.

Careful checks bring out that C7's save 50% of the cost and 75% in time over hand methods.

You'll want to try them—we'll be glad to demonstrate how the new power of the C7 can mean new savings.

Clevaloy Paving Breaker Moils and Chisels, Outlast two ordinary steels —are a cost and time saving combination with the C7. Try them together.

THE CLEVELAND ROCK DRILL CO.
3734 E. 78th STREET CLEVELAND, OHIO

CLEVELAND ROCK DRILLS

The Trail of the "Road Hogs" Becomes a Passable Road

WARCO
POWER GRADERS HAVE:

- One-Man Control
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- Three Sizes—Six Models
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- Attachments, including Independent Scarifier, Bulldozer, and Snow Plow

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BUCYRUS
OHIO

A remote mountain road, scarcely more than a trail, becomes a passable motor road under the ministrations of this pair of powerful WARCO "Road-Hog" Power Graders. Shale-like rock is cut, and thrown out to make a smooth pathway for vehicles. We will be glad to tell you more about WARCOS. Get in touch with our nearest Distributor, or write us direct.

Every Citizen is entitled to a passable road the year around. Why favor the few who live on main highways, when passable roads can now be provided for all, at costs within the reach of every community. Public Officials concerned with Road and Street problems, owe their taxpayers a complete investigation of WARCO Power Graders. Contractors, too, find WARCO Road Machinery a mighty profitable investment.

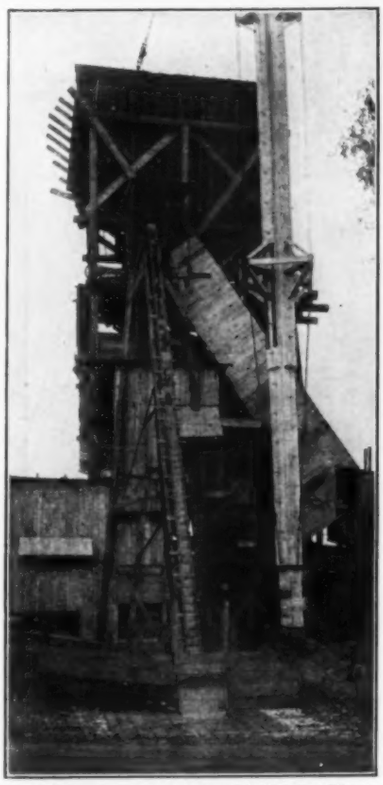
No longer need the whole neighborhood turn out to work the roads.

W. A. Riddell Company, Bucyrus, Ohio

POWER & DRAWN GRADERS—WHEELED SCOOPS—REAR-TYPE CRAWLERS FOR TRACTORS

Ransome—CENTRAL MIXING PLANTS

Three Yard Ransome owned by George M. Brewster & Co., Bogota, N. J. Photo taken 1930.



28-S Ransome in the Central Mixing Plant of McCall Construction Co., in Northern Illinois. Photo taken 1921.

THERE are good reasons why the following prominent representative manufacturers of concrete use Ransomes—

P. Flanigan & Son, Baltimore, Md.

L. G. Everist, Inc., Sioux City, Iowa

Chas. H. Fry Construction Co., Erie, Pa.

Ready Mixed Concrete Co., Pittsburgh, Pa.

General Material Co., St. Louis, Mo.

Hankins-Paulson Co., Uniontown, Pa.

Ready Mixed Concrete Co., Kansas City, Mo.

McClain Sand Co., Morgantown, W. Va.

Builders Supply Co., Bellingham, Wash.

Charles Warner Co., Philadelphia, Pa.

Ready Mixed Concrete Corp., New York, N. Y.

Ready Mixed Concrete Corp., Richmond, Va.

Super Concrete Corp., Washington, D. C.

Jahncke Service, Inc., New Orleans, La.

Caldwell Construction Co., Charlotte, N. C.

Corson & Gruman, Washington, D. C.

John P. Callaghan, Inc., Newark, N. J.

Fort Worth Sand & Gravel Co., Ft. Worth, Texas

Big Rock Stone & Material Co., Little Rock, Ark.

Avril Tru-Batch Concrete, Inc., Cincinnati, Ohio

Scranton Ready Mixed Concrete Co., Scranton, Pa.

Guaranteed Concrete Co., St. Paul, Minn.

L. E. Whitnam & Co., Austin, Texas

Ready Mixed Concrete Co., West Reading, Pa.

Geo. M. Brewster & Son, Bogota, N. J.

Carleton Company, Office, New York City; Plant, Brooklyn, N. Y.

Corson Construction Corp., New York, N. Y.

Birmingham Slag Co., Birmingham, Ala.

N. Ryan Company, Inc., Brooklyn, N. Y.

Samuel Braen's Sons, Hawthorne, N. J.

York Ready Mixed Concrete Co., York, Pa.

Liberty Corp., Philadelphia, Pa.

Union Paving Co., Philadelphia, Pa.

Camden Lime Co., Camden, N. J.

Write for Big Mixer Bulletin No. 122

Ransome Concrete Machinery Company

1850—Service for 81 Years—1931

Dunellen **New Jersey**

Hotstuf
TRADE MARK

MOHAWK HI-SPEED TRAILER
TRADE-MARK

SIGNS OF WELCOME

GREETING YOU AS YOU ENTER THE ARENA

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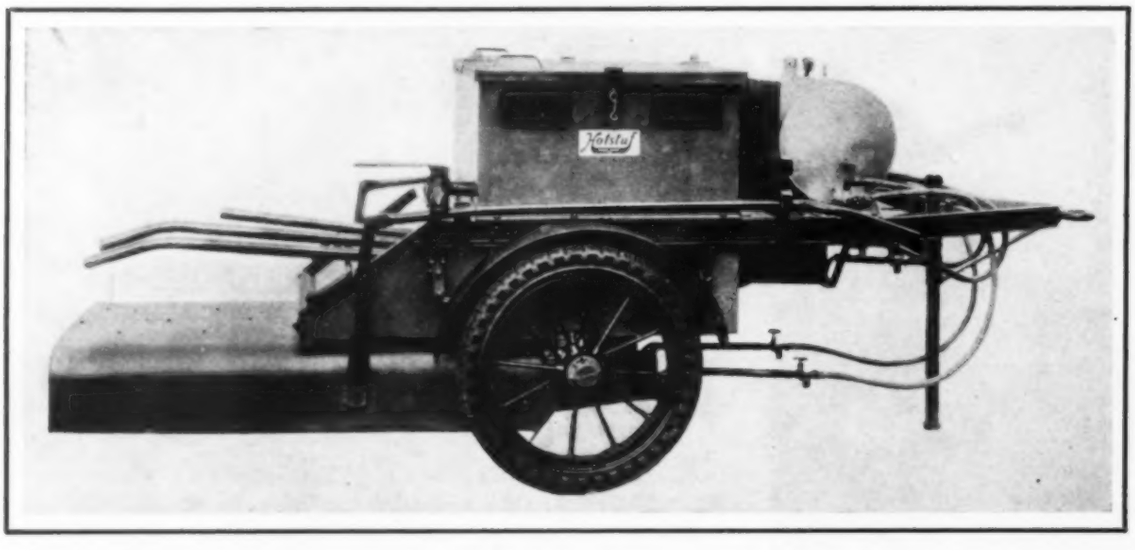
IT'S NEW!

ANOTHER MOHAWK LEADER THREE PRACTICAL EQUIPMENTS IN ONE

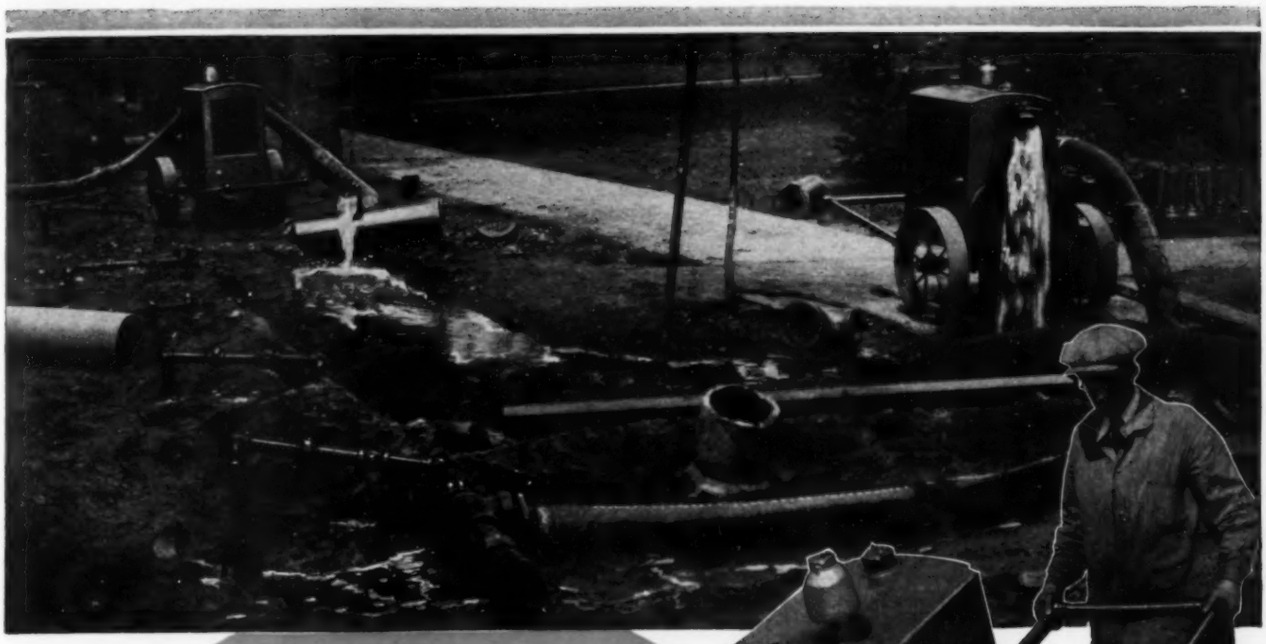


THE MODERN CONTRACTOR'S EQUIPMENT INCLUDING AN ASPHALT MELTING COMPARTMENT, A TOOL HEATER AND A SURFACE HEATER. IT CAN BE FURNISHED IN COMBINATION OR IN SEPARATE UNITS.

SEE IT AT OUR BOOTH

MOHAWK ASPHALT HEATER CO.

SCHENECTADY ❖ **NEW YORK**



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Portable Centrifugal Pump

Homelite Facts that get home

Self Priming—no foot valve. No vacuum auxiliaries of any kind. Capacity 25,000 gal. per hr. Suction lift 20 feet. Powered by LeRoi 8-10 H.P., 4 cylinder gasoline engine. Bronze open type impeller. Handle telescopes into frame when not in use. Weighs 730 lbs.

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HOMELITE CORPORATION

75 Riverdale Avenue, Port Chester, N. Y.

HOMELITE

4" and 2" Portable Self-Priming Centrifugal Pumps

Also Portable Blowers, Air Compressors, Electric Generators—all powered by Homelite Air-Cooled Engines

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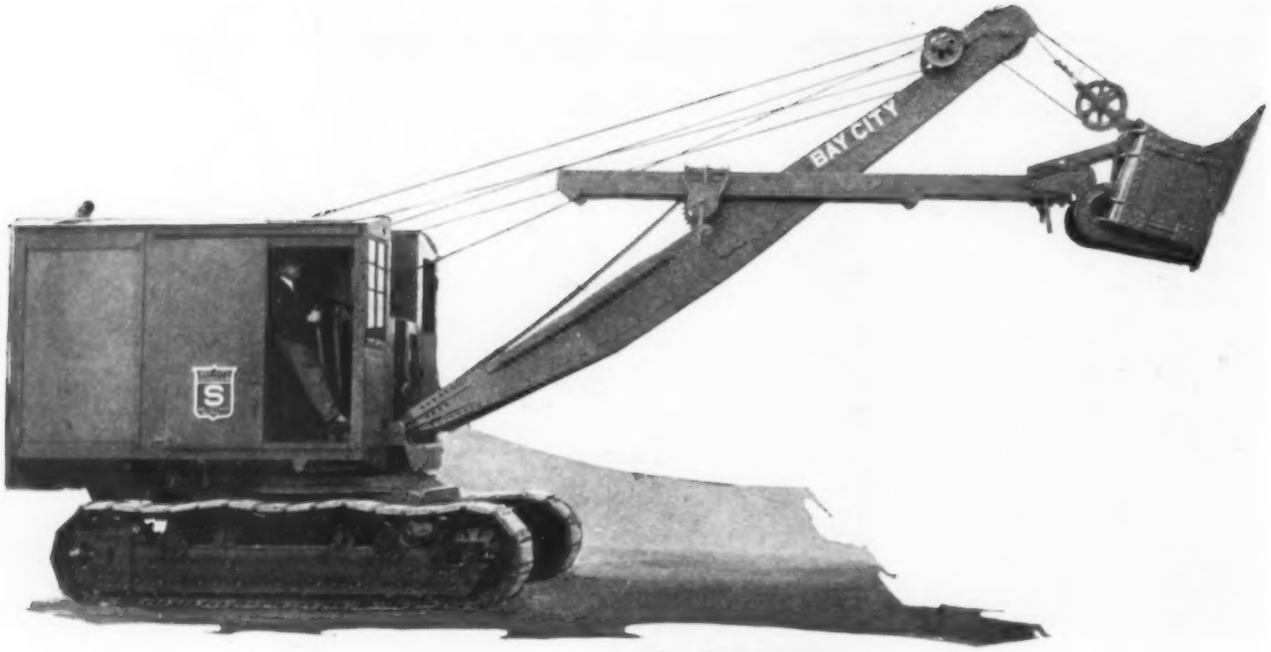

AND NOW!

MODEL-S–
full size one-yard
SHOVEL

This new addition to the BAY CITY *family* widens the range of operation of these *fast workers* from ¾ yard to 1 yard.

Model S full size 1 yard is the big brother of Model R. It is built like the original but is heavier and more rugged to take care of the larger 1-yard capacity.

It is full revolving and convertible to shovel, crane, trench-hoe, clamshell, dragline or backfiller.

For speed, power, stability and dependable service Model S has no superior in its class. Powerful motor unit, full length crawlers, unit-cast car body and revolving machinery base. Built throughout as BAY CITY is known to build thoroughly dependable shovels.

Write for complete details.

BAY CITY SHOVELS, Inc.

New York Office—302 Broadway **BAY CITY, MICH.**

BAY-CITY SHOVELS

THE BAY-CITY FAMILY OF FAST WORKERS

faster, stronger CONCRETE winter or summer

Building contractors have learned that concrete, cured by Calcium Chloride in the mix, attains high early strength and permits much earlier release of forms.

Also that Calcium Chloride sufficiently accelerates the setting action of the mix to prevent frost damage. It is the only curing method that will make up for strength loss due to lower temperatures. This loss may amount to 50 pounds per square inch for each degree lost during the curing period.

Building contractors are invited to write to to any of the three companies sponsoring this advertisement for latest information regarding this improved method of concrete curing.

CALCIUM CHLORIDE

Send this coupon to any one of these Calcium Chloride Publicity Committee Members.

Dow Chemical Co.
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Solvay Sales Corp.
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Without obligation please send latest reports and data on Calcium Chloride concrete curing practice.

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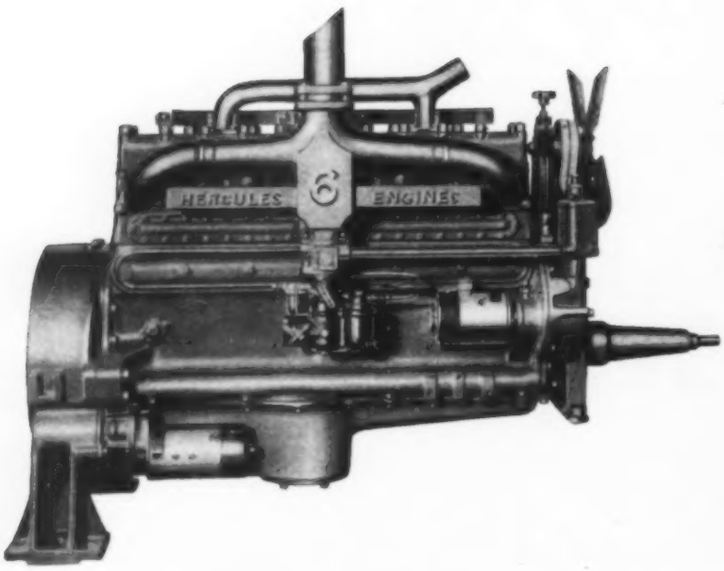
HERCULES ENGINES



THE "HX" SERIES OF SIXES

HERCULES "HX" Series Engines have been developed with a particular view to meeting modern requirements for heavy-duty, six-cylinder power in the higher horsepower ranges

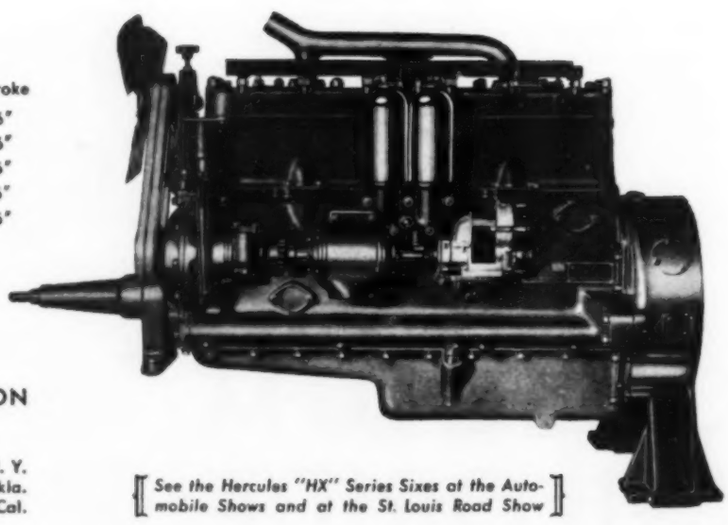
Like all Hercules Engines they are simple, rugged, advanced in engineering. Special attention has been given to effective cooling and lubrication.

Full provision has been made for all possible accessories.

The reputation for all-around superiority which Hercules Engines have earned throughout the heavy-duty power field is still further enhanced by the "HX" Series Sixes. Complete information and details will gladly be furnished on request.

SPECIFICATIONS

Model	Cylinders	Bore	Stroke
HXA	6	4-3/4"	6"
HXB	6	5"	6"
HXC	6	5-1/4"	6"
HXD	6	5-1/2"	6"
HXE	6	5-3/4"	6"



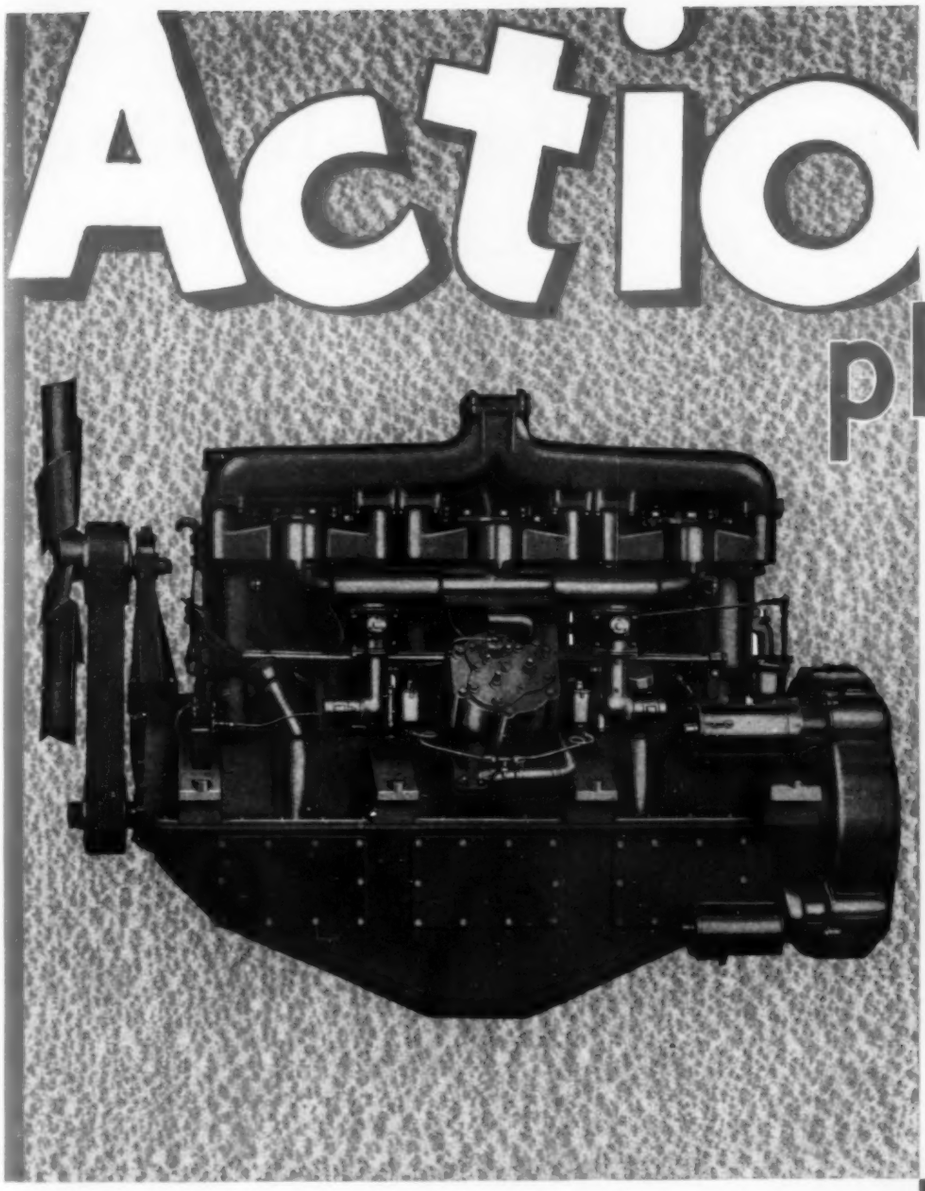
HERCULES MOTORS CORPORATION
Canton, Ohio, U. S. A.

New York Office: Chanin Building, New York, N. Y.
Mid-Continent Office: Mayo Building, Tulsa, Okla.
West Coast Office: Russ Building, San Francisco, Cal.

See the Hercules "HX" Series Sixes at the Automobile Shows and at the St. Louis Road Show

Action... plenty

WHERE LE ROI ENGINES WORK!



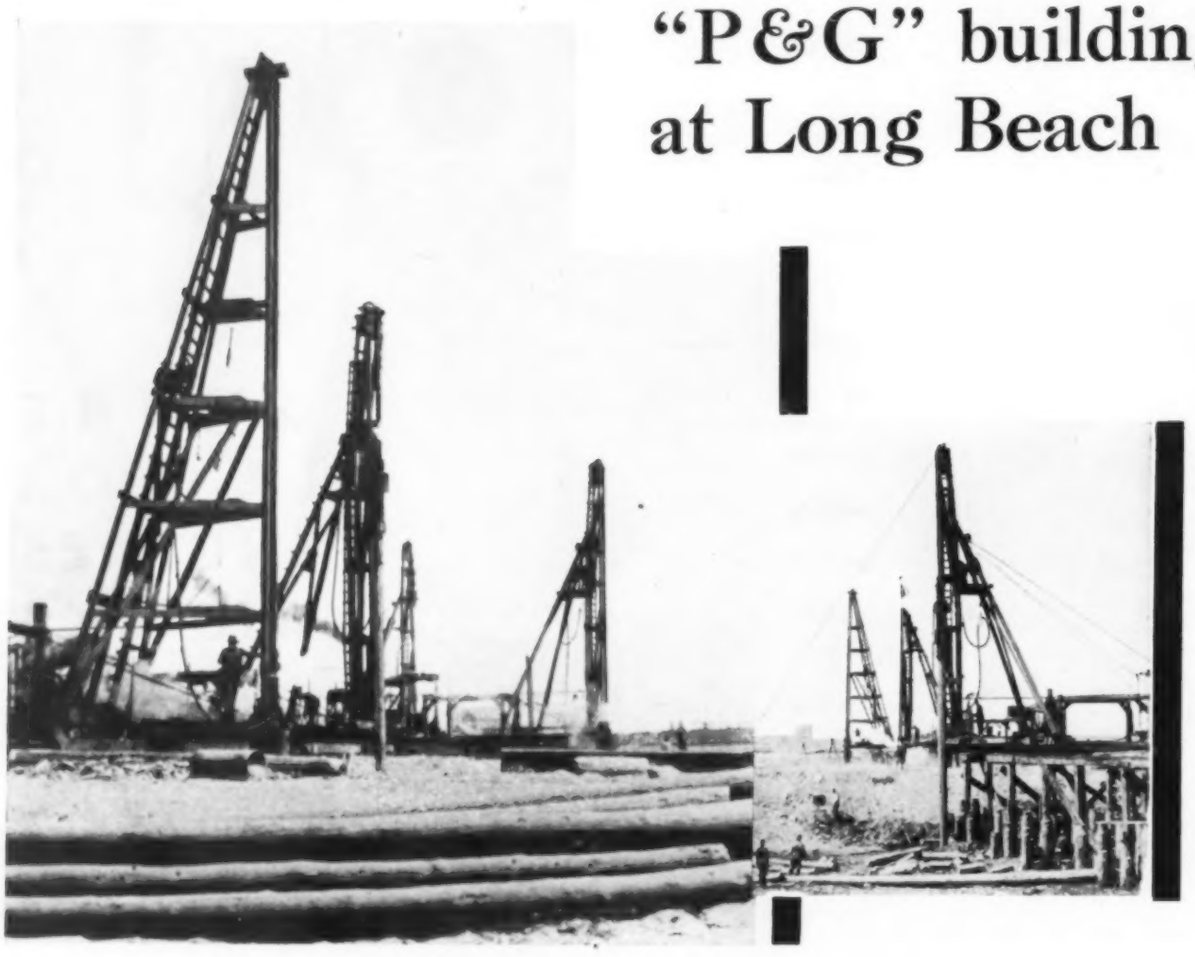
WHETHER they are gouging out the deepest excavation . . or spinning the propeller of the loftiest aircraft . . gasoline engines have but one function . . that is to supply ample power dependably . . . Le Roi Engines furnish uninterrupted power . . give action always to construction equipment, serving a wide range of applications. They are engines, tried, tested and proven . . the choice of contractors the world over who depend upon such machinery for profit. Standardize on Le Roi powered equipment . . it is a profitable policy.

LE ROI COMPANY, Milwaukee, Wis.

LE ROI ENGINES

LE ROI FOR DEPENDABLE POWER

"Warrington-Vulcans" on the "P&G" building at Long Beach



ON THIS big job of pile driving at the Procter & Gamble Company's new plant at Long Beach, California, Merritt-Chapman & Scott Corporation, the contractors, used No. 1 type Warrington-Vulcan Pile Hammers—after starting the work with pile hammers of another make.

It was found, however, that the other type of pile hammer that would fit in the leads could not drive the piling, and the "heavy-ram-low-velocity" Warrington-Vulcans were used to displace the others—with immediate good results.

Warrington-Vulcan Pile Hammers incorporate a real *punching* action. Their design represents engineering principles applied to pile driving, in order to get the most effective use of the driving energy. There is no wasted energy but the utmost in penetration.

Write for descriptive literature.

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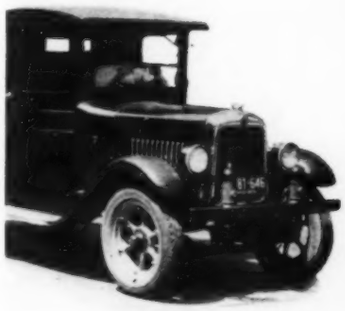
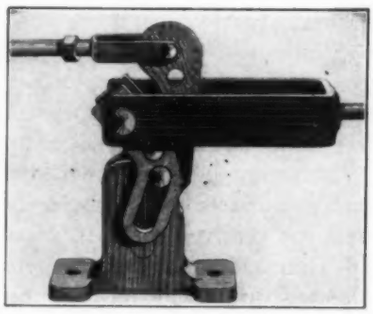
Warrington-Vulcan

How to Haul Dirt

FASTER *and at* LOWER COST . . .



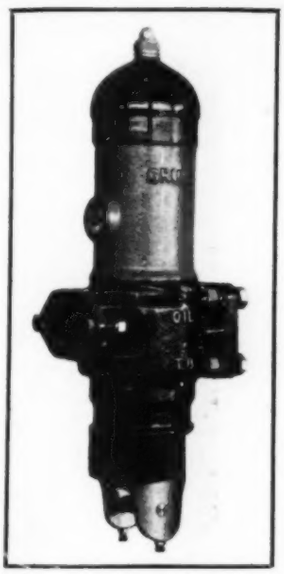
There are only two variables in hauling dirt—the time consumed in each trip and the cost of maintaining the trucks. The family of Cleco-Automotive Products contains two products that can substantially effect both of these



factors. These products are Cleco-Gruss Air Springs and the Cleco Multi-Power Brake Booster.

Air Springs eliminate road shock and driver fatigue and make practical higher rates of speed under any road conditions. The Cleco Brake Booster (which amplifies pedal pressure 300%) makes these higher speeds safe and produces a long, soft pedal stroke that gives the driver complete confidence in his brakes.

Both of these products quickly pay for themselves in maintenance cost alone. Air springs, on the basis of actual test, reduce chassis maintenance from 10% to 15%. The Cleco-Booster, a low-cost, high-performance mechanical unit, reduces brake maintenance very substantially.



Air Springs make higher speeds practical; the Cleco Booster makes it safe. The two combined may mean the difference between profit and loss. Write today for the cost of equipping your trucks. The Cleveland Pneumatic Tool Company, Cleveland, Ohio.

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MANUFACTURED BY THE CLEVELAND PNEUMATIC TOOL CO., CLEVELAND, OHIO

STRUCTURAL STEEL CREATED THE SKYSCRAPER

STEEL CARRIES ACRES TO THE SKY

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A CROWDED CITY pleads for space . . . swiftly, floor on floor, the sure steel climbs—and thirty-five or forty city "plots" stand where there was one before.

Structural steel not only multiplies the precious bit of ground. It increases *rentable* floor area. Its great strength is not handicapped by excessive bulk, so interiors may be larger without conspicuous construction members. Steel comes to a job ready to go into place. It is unaffected by rain, freezing or intense heat. Erected quickly, wherever and whenever men can work, it saves time, labor, interest charges.

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Before building anything, find out what steel can do for you. The Institute serves as a clearing house for technical and economic information on steel construction, and offers full and free co-operation in the use of such data to architects, engineers and all others interested.

The co-operative non-profit service organization of the structural steel industry of North America. Through its extensive test and research program, the Institute aims to establish the full facts regarding steel in relation to every type of construction. The Institute's many publications, covering every phase of steel construction, are available on request. Please address all inquiries to 200 Madison Avenue, New York City.—In Canada, to 710 Bank of Hamilton Bldg., Toronto, Ontario. District offices in New York, Worcester, Philadelphia, Birmingham, Cleveland, Chicago, Milwaukee, St. Louis, Topeka, Dallas, San Francisco and Toronto.

"SKYSCRAPER HANGAR IN A METROPOLIS," BY HUGH FERRISS. AN ENLARGEMENT, ON SPECIAL STOCK FOR FRAMING, WILL BE MAILED WITHOUT CHARGE TO ANY ARCHITECT, ENGINEER OR BUSINESS EXECUTIVE.

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STEEL INSURES STRENGTH AND SECURITY

Wear Them Out on the job

Note extreme oscillation allowed by Rogers Patented Rocking Axles. Load is distributed over whole road width, tire life is lengthened and stronger frame construction is made possible.

—not on the pavement

SHOVELS wear out fast enough *on the job* without subjecting them to the extra abuse of travel on hard pavement *between* jobs.

Every contractor and rigger should have a copy of this new circular just off the press, showing just what it means to men and machinery to have heavy equipment on the job when it's needed, without the usual expense and delay.

"The World's Standard" in every respect, the Rogers heavy-duty trailer provides unbelievable strength with its new, stronger steel-alloy construction, to meet amply every strain imposed by load or road. Weight is distributed evenly over road surface by the Rogers patented rocking axles which make possible *more tire-surface per foot of trailer-width than on any other trailer made.*

Made in capacities from 10 to 100 tons. Write for full details—today!

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HEAVY DUTY
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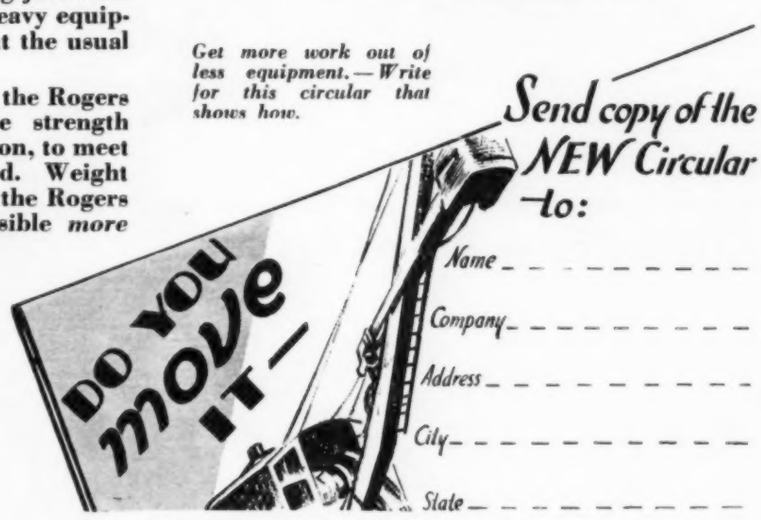
Get more work out of less equipment.—Write for this circular that shows how.



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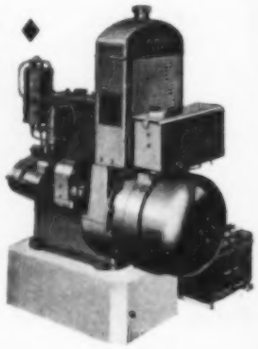
SEE the job through

EXTRA yardage ahead of schedule often means a bonus —failure to meet the contract date invariably means a loss. That's the reason why the experienced earth-mover utilizes every bit of time good weather permits.

He rigs his equipment with Kohler Electric Plants —thus is able to operate nights when need be. Bright, gleaming electric light spot-lights the job—the shovels dig day-in and night-through — machinery doubles dividends on the investment.

Kohler Plants are compact and self-contained. They can be transported anywhere with little bother, for they *do not* require large storage batteries. Standard current is generated at 110 or 220 volts A. C. or D. C. Capacities range from 800 watts to 10 K. W.

Ruggedness and portability give to Kohler Electric Plants the special qualities excavating contractors are looking for. Send coupon for information about Kohler Electric Plants as specialized to your needs.



Kohler Co. *Founded* 1873. Kohler, Wis.—*Shipping Point,* Sheboygan, Wis.—*Branches in principal cities.* . . . Manufacturers of Kohler Plumbing Fixtures.

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Gentlemen: Please send catalog describing Kohler Electric Plants.

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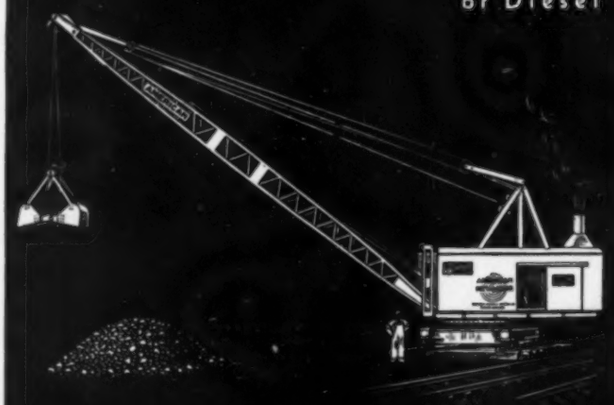
Clamshell or Dragline

Steam or Electric Gasoline or Diesel



65 to 100 Foot Booms

2½ to 10 Ton Loads

Quality Engineering

AMERICAN HOIST & DERRICK CO.

Saint Paul, Minnesota

HERE'S ONE THAT DOES EVERY OPERATION—

SEE IT AT THE ROAD SHOW

THE NEW PERFECTION MECHANICAL POWER HOIST

The only mechanical power hoist on the market that will respond to every required operation and is FULL AUTOMATIC.

Furnished with a complete line of bodies for every capacity and purpose.

Now ready for Ford, Chevrolet and other short wheel base trucks.

POSITIVE CONTROL

All operations—raising, lowering and dumping are controlled from the driver's seat.

STOPS *automatically* at the full dumping position.

STOPS *automatically* at the riding position.

CAN BE STOPPED at any intermediate position.

CAN BE EITHER RAISED OR LOWERED from any intermediate position.

The LOAD CAN BE DUMPED or the BODY LOWERED to any position while the truck is IN MOTION. It rises to full dumping angle in five seconds. The position of the lift levers, lock the body to the frame *automatically* in riding position.

Simplicity of design and sturdy construction make it practically a trouble-free, fool-proof job.

This year we have for you a time tested, mechanical hoist that will do every operation any hoist will do regardless of type. See it—get the prices and judge for yourself.

THE PERFECTION STEEL BODY COMPANY
Dept. C.M.
GALION, OHIO, U. S. A.

PERFECTION BODIES AND HOISTS

DIXON
brings to construction all the advantages of GRAPHITE

For the Joseph Dixon Crucible Company sees an obligation in its service to the construction industry. And through incorporating the basic advantages of natural flake graphite in its Graphite Products, fulfill this obligation.

The graphite used in all Dixon Graphite Products is a natural flake graphite which in purity, in uniformity, in lubricating and protecting qualities has never been equalled.

In Dixon's Graphite Products, the construction industry finds an answer to many of its difficult lubrication problems. Write for Booklet No. 86KP.

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Graphite Cup Grease
Waterproof Graphite Grease
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Industrial Graphite Paint

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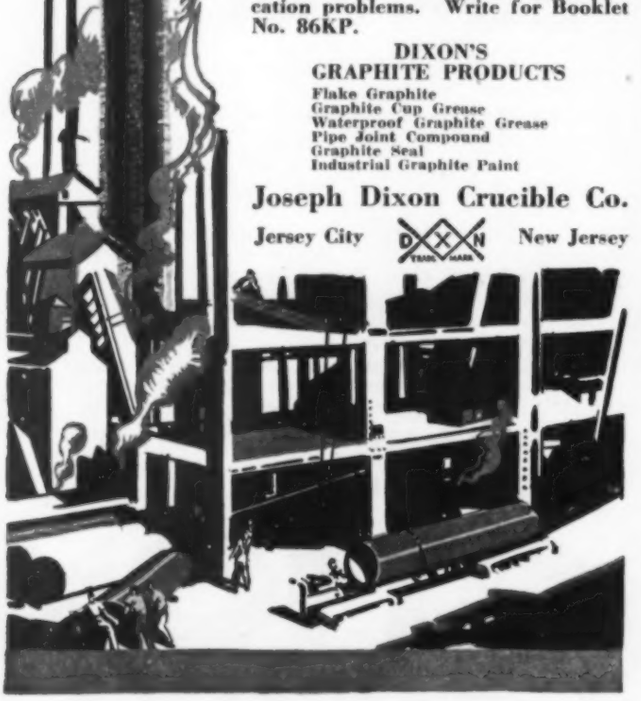

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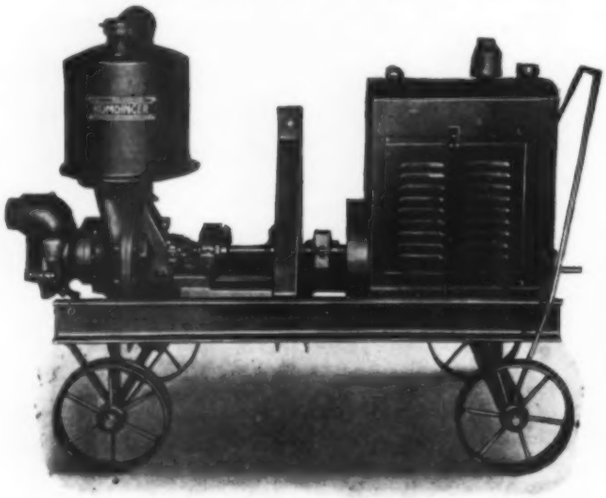

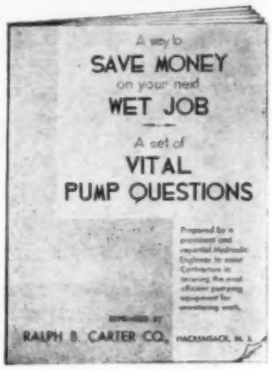

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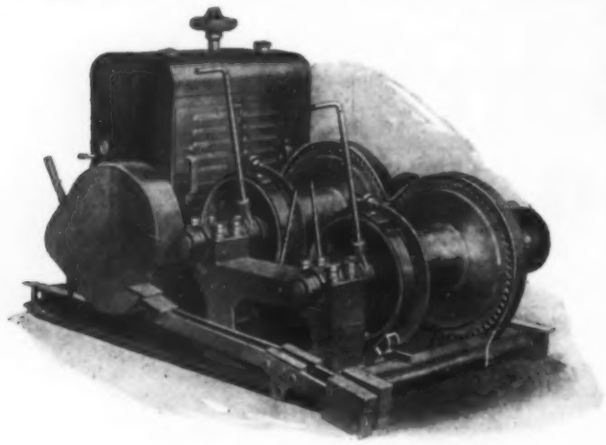

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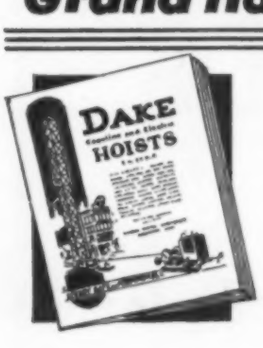

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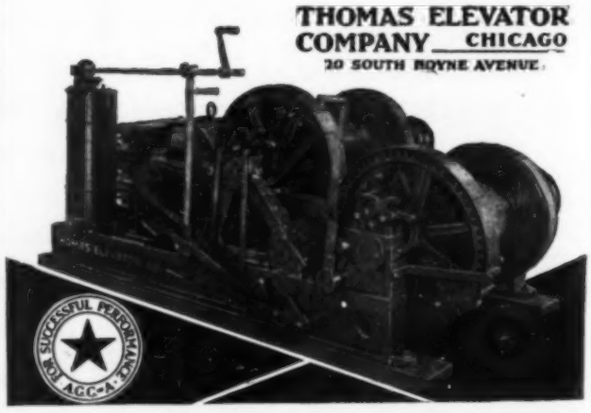
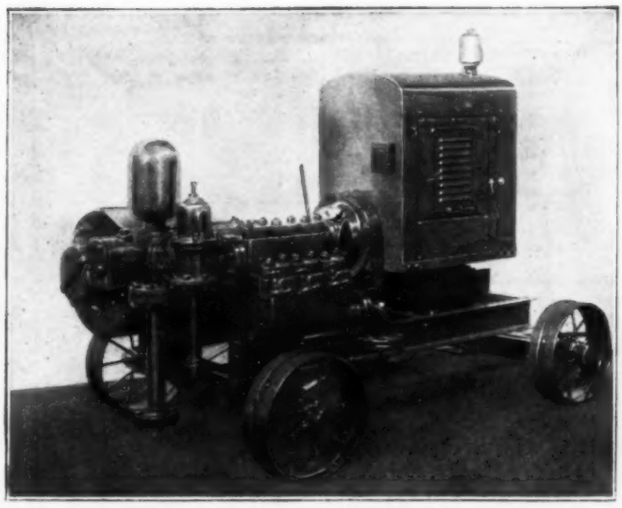


Not a Cannon

..it's a piece of Contractor's Pipe



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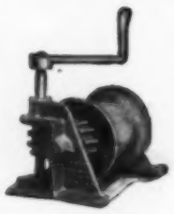

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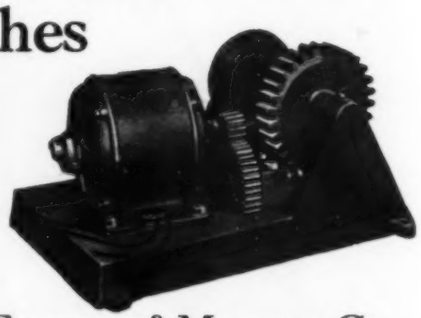

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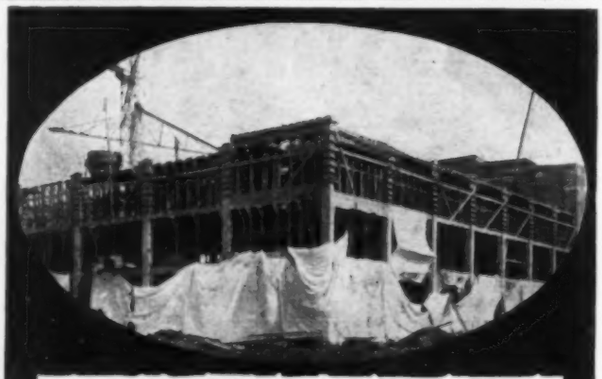

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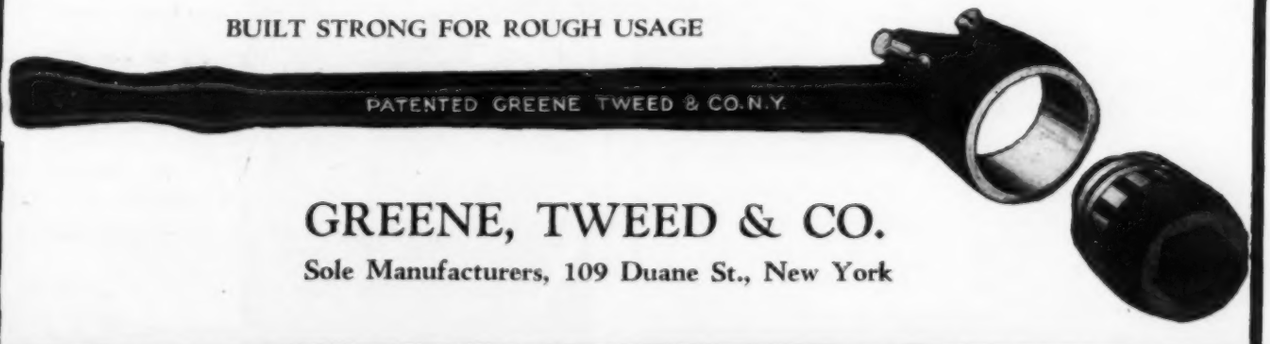

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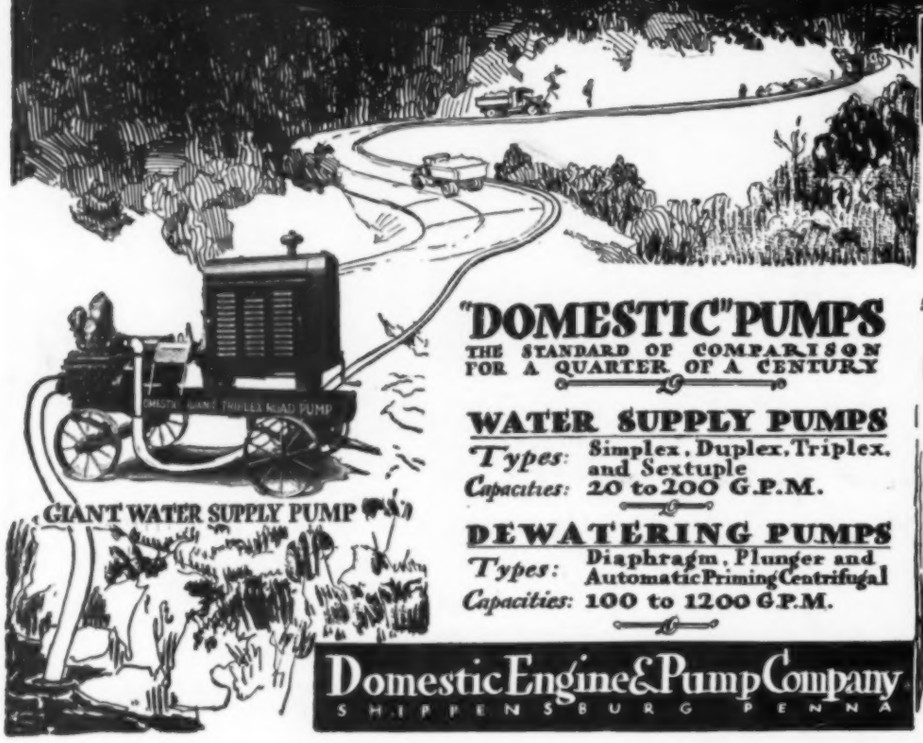

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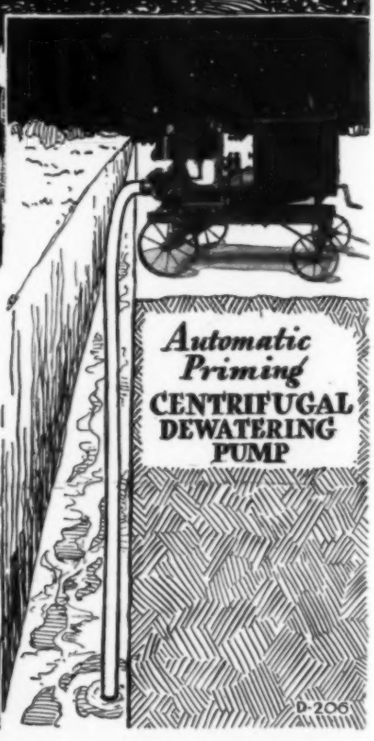

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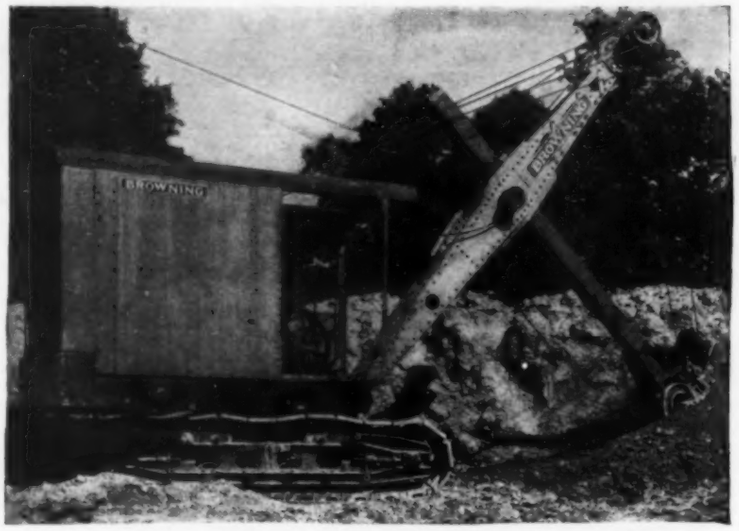

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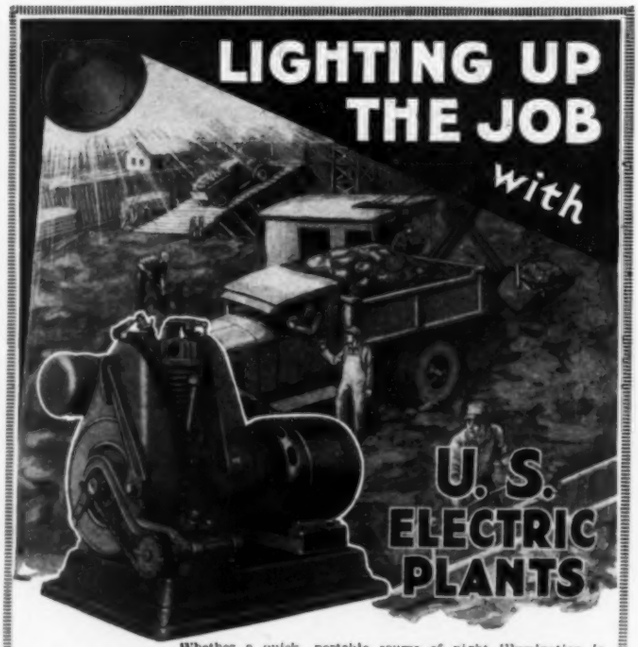

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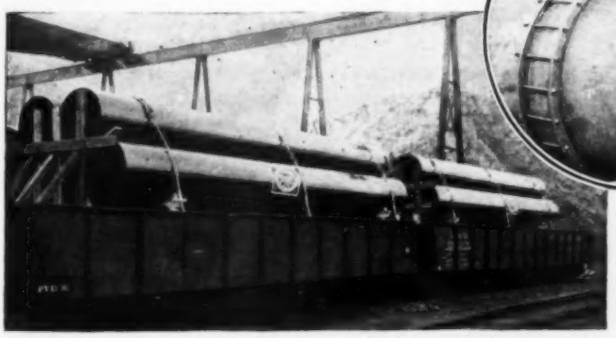
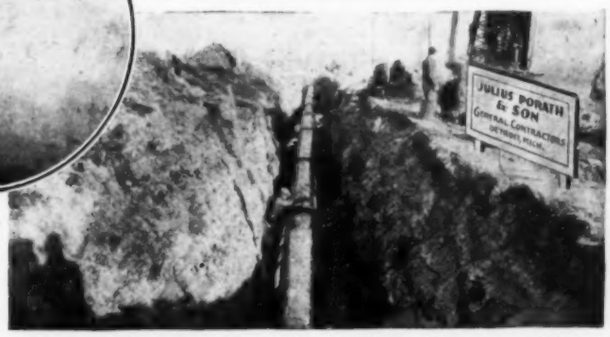


Partial shipment of 5,000 feet of 36-inch Biggs electrically welded steel pipe with plain ends for Dresser couplings, for the City of St. Louis, to be installed by the Water Department with its own force.



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A Watson-Stillman Hydraulic Bender Bending Conduit Pipe for Subway Work. Note the economy of Labor.

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If you do you need a

Watson-Stillman Hydraulic Pipe Bender

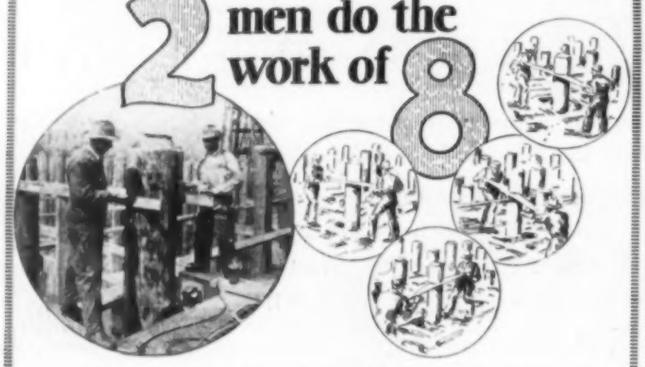
These machines are not only rapid and economical of labor, but the bends are made uniform and without danger of buckling or crushing.

We build pipe benders in a variety of types and sizes as well as a full line of Hydraulic Machinery including jacks, pumps, accumulators, presses, shears, etc.

Write for catalogs.

THE WATSON-STILLMAN CO.
1014 Evening Post Bldg., New York City

2 men do the work of 8



—this faster way of cutting heavy timber

These dock builders will tell you what they think of Timber Wolf Portable Sawing Machines. Approximately 4,000 timber piles were cut on the dock shown. Two men with the Timber Wolf Saw averaged twenty-five 16 in. to 23 in. old growth yellow fir piles per day—4 to 5 times as many as two men with a hand-saw! Two men doing the work of 8 means profits to you. Write for other interesting Timber Wolf figures.

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especially constructed for highway work. Is just plain Transit with Level under telescope, rigidly built to hold adjustment under hard usage.

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SEARCHLIGHT SECTION

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You Want What You Want When You Want it

—and Good Used Equipment may often meet an urgent temporary need—or a permanent one.

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ANNOUNCING THE

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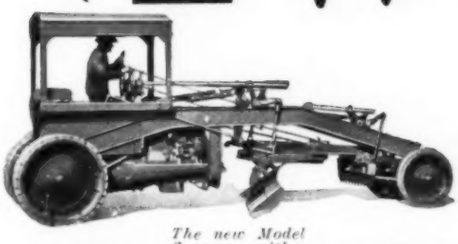
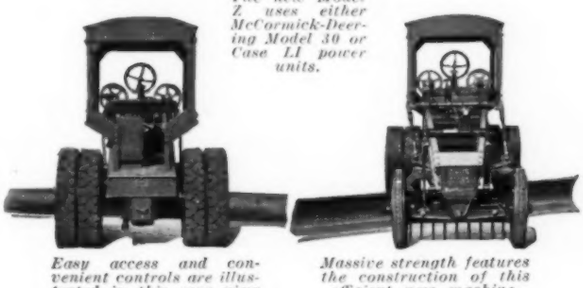
NEW MODEL-Z WEHR GRADER



The new Model Z uses either McCormick-Deering Model 30 or Case LI power units.



Easy access and convenient controls are illustrated in this rear view of the Model Z.

Massive strength features the construction of this efficient new machine.

A GREAT new grader — built to BIG specifications—to establish BIG records of performance!

It's a real giant for road-maintenance jobs. Investigate the possibilities of this latest Wehr development—they are of profitable interest to every road man!

Write for detailed description and see the Model Z at the St. Louis Road Show. You'll find it the center of attraction at the Wehr Booth, No. A63—it will be the grader everyone's talking about!

See the complete Wehr line, including the Great New Model Z, at the Good Roads Show, St. Louis, January 10 to 16.

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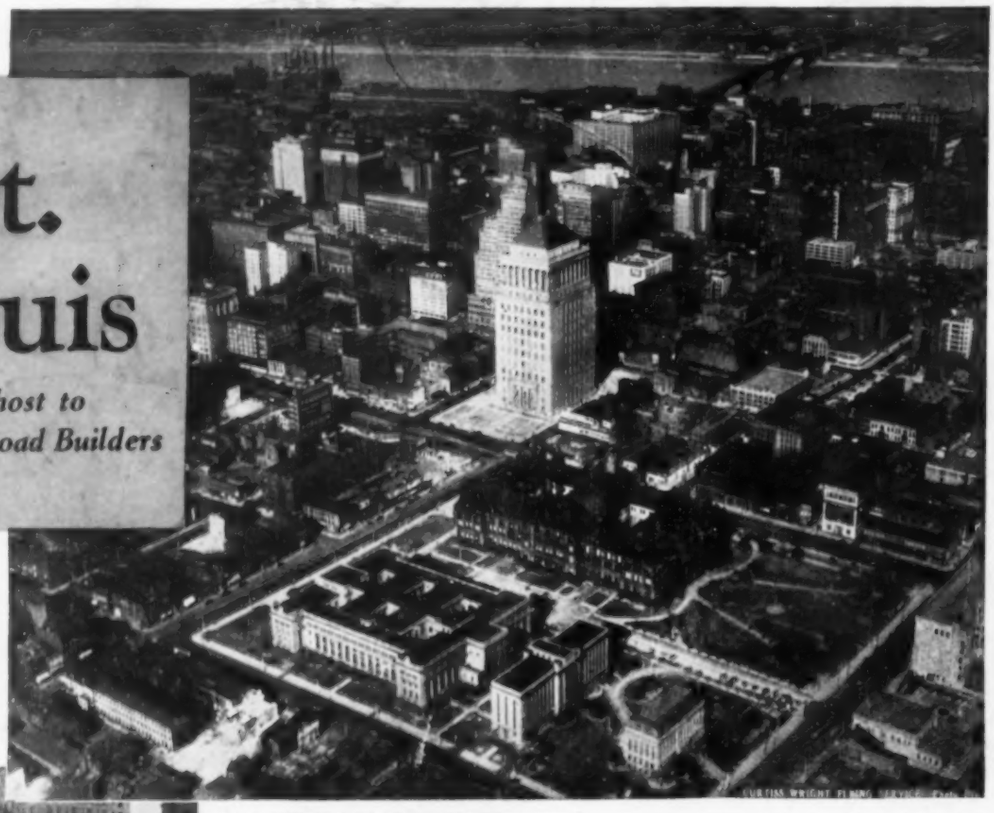
St. Louis

1931 host to American Road Builders



Air view of St. Louis, Mo.

Under the heavy traffic of Kingshighway, St. Louis, Mo.

over 500,000 square yards

The transfer of the Road Show from Atlantic City, N. J., to St. Louis, Mo., represents no change at all in one respect. It simply means a shift from one city with more than 500,000 square yards of TEXACO Asphalt paving to another city with over half-a-million square yards of TEXACO-paved streets.

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